UNIV. OF CALIFORNIA.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY, Limited,

168-177 POTTER BUILDING, NEW YORK.

Established 1874. Incorporated 1889.

W. J. JOHNSTON, Prest. C. E. STUMP, Treas. and Bus. M'g'r.

Telephone Call: Murray 586. Cable Address: "Electrical," New York.

T COMMERFORD MARTIN and JOS. WETZLER, M. E., Editors.

WM. A. ROSENBAUM, Editor Patent Department.

WALTER T. HUNT, Advertising Department.

New England Office, 8 Cook Building, Boston.

W. IRVING BARKER, Manager.

Western Office, 44 Lakeside Building, Chicago.

W. A. NICHOLS, Manager.

Philadelphia Office, 31 City Trust Building.

EDWIN F. CLARKE, Manager.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.

(Including Postage in the U. S., Canada or Mexico.)

IN CLUBS of four or more, $2.50 a year each; with a free extra copy to the getter up of a club of 8. Foreign subscription, $5 a year.

In requesting your address changed, give **old** *as well as new address.*

ESTABLISHED **SIXTEEN** YEARS AGO, **THE ELECTRICAL WORLD is the Pioneer Electrical Journal of America, and has well maintained its lead. It has the LARGEST CIRCULATION of any electrical periodical in the world, and is the BEST ADVERTISING MEDIUM.**

Advertising Rates are much lower than those of any other similar publication, circulation and standing considered, and vary according to space, position and number of insertions. Quotations promptly furnished. For Sale Notices, Situations or Help Wanted, $1 to $2 an issue.

Correspondence, views and opinions on all topics within the province of this journal are cordially invited from any part of the world. We will thank readers to forward to us—**promptly** as they occur—**Items of News,** or information relating to any application of Electricity, also marked copies of their local papers containing anything likely to interest electricians. Anonymous communications cannot be noticed, nor can rejected manuscript be returned, unless accompanied by the necessary postage when received.

Matter for the **Editorial** Department should be addressed to

The Editor of The Electrical World, New York.

Subscriptions and communications relating to **advertising** or the **business department** should be addressed to

THE W. J. JOHNSTON COMPANY, Ltd.,

Potter Building, New York,

OR ANY OF THE BRANCH OFFICES.

VOL. XIII. NEW YORK, MARCH 16, 1889. No. 11.

CONTENTS.

PAGE.

ILLUSTRATED ARTICLES:
The Centennial of Ohm (Portrait) ... 156
A Miniature Battery. By L. H. Farnham ... 156
Electric Distribution in Paris ... 156
The "K. & W." Cut-Out ... 156
The Edison Central Station at Easton, Pa ... 157
Immisch Electric Locomotive for Mines ... 158
Electric Lighting in Dieulefit and Valreas ... 159
The Sprague Roads at Boston, Mass., Hartford, Conn., and Davenport, Ia ... 160
The Purification of Feed Water for Boilers ... 161
The Scranton, Pa., Electric Power Station ... 161
The Riley Elevated Electric Railway System ... 162
Brown's Self-Regulating Oil Cup ... 164
On Certain Phenomena Connected with Imperfect Earth in Telegraph Circuits. By A. E. Kennelly ... 165

CORRESPONDENCE:
Iron Sheathing and Speed in Long Cables. By A. E. Kennelly ... 158
A Standard of Insulation. By C. Wirt ... 162

EDITORIAL:
Paragraphs ... 155

MISCELLANEOUS:
Prof. Rucker on Electrical Stress ... 156
Winding Clocks Electrically ... 156
Progress at the Deptford Ferranti Station ... 156
The Slow Baking of Dynamo Armatures. By R. H. Sterling ... 157
The Knowles Method of Preparing Storage Battery Plates ... 159
Prize Competition of Electricity Meters ... 160
Vienna Soft-Cored Carbons ... 161
Some Queer Joints. By C. M. Doten ... 161
Pure Air and Electric Lighting ... 161
Voiding Edison Patents in Canada ... 163
Some Figures on Electric Train Lighting ... 163
Meeting of the Board of Electrical Control ... 164
The Massachusetts Legislature and Electric Railway Wires in Boston ... 164

SPECIAL CORRESPONDENCE:
New York Notes, 166; New England Notes, 166; Philadelphia Notes, 166; Western Notes, 167; Southern Notes ... 167

DEPARTMENTS:
The Telegraph, 167; The Telephone, 168; The Electric Light, 168; Applications of Power, 169; Personals, 169; Miscellaneous Notes, 169; Business Notices ... 170

Our Illustrated Record of Electrical Patents ... 170

Telephone Legislation. THE repeal of the law in Indiana regulating telephone rates should have its lesson for those who seek elsewhere to compel the local telephone companies to do business at a loss. The public in Indiana were greater sufferers than the companies, although the latter had practically to suspend operations, and the return to a more healthy state of affairs is hailed with universal satisfaction and delight. Illinois, New York and a few other States might make note of this little episode.

The Ohm Centennial. THE youth of our great science is well exemplified by the fact that to-day (March 16) is the hundredth anniversary of the birth of Ohm, whose death occurred but a few years ago. Ohm's law lies at the very foundation of electrical work, and yet it is an altogether modern conception and discovery. The world is greatly indebted to Ohm, a man of not less noble character than intellect, and it is right that his memory should be honored, as well in America and England as in his native country, Germany.

The Paris Meter Competition. WE give in another column the conditions which are to be fulfilled by the meters submitted by competitors to the municipality of Paris, a subject in which we know a number of our readers will be particularly interested, from the fact that a large number of inquiries have reached us with regard to the points on which the prizes will be awarded. It is safe to say that a large number of meters will be submitted, and that America will be well represented; and we hope that one of her sons may be victorious in this competition.

Defects in Armatures. RECENTLY we had occasion to draw attention to a communication in which one of our contributors brought forward prominently the fact that most armatures of dynamo-electric machines contained within themselves the elements of destruction; and he drew attention prominently to the fact that sufficient means are not provided for holding in place the wires upon the periphery of the armature. In this issue a contributor, writing on the same subject, calls attention to another inherent weakness in armatures due to the quality of the insulation usually employed, which is in time affected by the heating of the armature. It would, therefore, seem, as pointed out and was proved by experience, that some non-combustible inorganic insulation ought always to be employed to the exclusion of such as may be deteriorated by the action of heat.

Iron vs. Hemp for Cables. THE discussion of the relative merits of iron and hemp as a covering for deep sea cables is taken up in our columns this week by Mr. Kennelly, who, leaving aside all questions concerning the mechanical advantages or disadvantages of such coverings, discusses the electrical side of the problem. He brings out a new consideration in support of the theory that iron armor does not exert a retarding influence upon the signals transmitted through the cable. If this were the case, argues Mr. Kennelly, the duplexing of cables would necessitate the introduction of this factor in the balancing on the artificial side; but, as experience has shown that a balance can be obtained by copying only the electro-static condition of the cable and its resistance, it follows that the electro-magnetic disturbance, if it exists at all, is a vanishing quantity. Mr. Kennelly adheres to this explanation and strengthens this position by reference to the mathematical proof which has been furnished regarding this subject.

Equalizing Pressure. AMONG the novel details enumerated in our description of the new Edison central station just installed at Easton, Pa., none will probably excite more interest and arouse more speculation than the statement that the system is automatic in its regulation, and that the feeder equalizers heretofore employed in Edison stations have been entirely done away with. On first thought it might appear that such a result could, of course, be obtained by an increase in the size of the conductors. But such is not the case; and though we are for the present unable to give our readers fuller details, it may be remarked that the method employed is an exceedingly simple one and involves practically no greater expense than that entailed by the equalizers heretofore employed. We need hardly draw attention to the great importance of being able to maintain automatically a practically constant pressure throughout an entire system of distribution. It means a definite gain and a satisfactory service in so many respects that the introduction of this improvement must be considered one of the most important that has been accomplished in recent years in this class of central station work.

New York Subway Work. MAYOR GRANT is evidently determined to get the wires underground as soon as possible, but we fear that his knowledge is not equal to his enthusiasm. In fact, it is impossible for any one who has not made a study of the subject to realize how great and many are the difficulties connected with undergrounding the wires, and certainly Mayor Grant has not yet had time to master the question. If he had, he would, we believe, show a little more consideration for those who have made an effort in good faith to use the subways. When a corporation has spent $140,000, as the Metropolitan Telephone Company has, in recent underground work, it is at least entitled to civility. Mayor Grant has great powers, but he has still to learn that, like those of King Canute, they have their limits. What may happen with even the best of subway systems is shown in our article this week on the Paris subway or sewer system. This subway is often referred to, and properly, as a good example of what can be done in this direction; but it will be noted that already in Paris the subway is of no use to the new companies, and that they must look elsewhere for accommodation. In this connection it is not amiss to point to the method employed at Dieulefit, as illustrated in another of our articles this week, of running the leads of an alternating system along the roofs and then dropping them down to the street below for distribution. Many objections are minimized by such a method.

City Electric Roads. BOSTON has recently been the scene of an animated discussion as to the advantages and disadvantages of overhead systems for electric roads. We publish this week a summary of the most important evidence presented at the hearings before the Committee of the Massachusetts Legislature. As the result of the inquiry, it must, we think, have been made clear that the potential of 500 volts now ordinarily used is not dangerous to human life. We have heard of a horse being killed by it, and we have also heard of a mule being improved by it, but we have yet to hear of any accident that has been fatal, or even serious, to the passengers or passers-by on any electric road either in Europe or America. No such case, in fact, is on record, and, as was pointed out at the hearings, a potential of 400 volts has been used for years on Western Union lines without the slightest trouble or inconvenience to anybody. Now the question arises whether the people of Boston are satisfied with an overhead system. On this point there is a conflict of testimony, but even the sharpest critics admit that it would be and is far preferable to horses. The probability, therefore, is that Boston will soon have 200 or 300 miles of overhead system in operation, and that it will have no reason to regret the change from animal to electric locomotion. In New York, however, the case is different. We do not believe it possible to obtain permission here for even a mile of overhead work, except, perhaps, under the elevated roads, where the wires could be fixed to the structure. Beyond that, however, the field is restricted to conduit systems and to storage, and New York will soon, if we mistake not, present good examples of both of the latter methods. In fact, the Julien storage cars are already a familiar sight, and that they are popular was evidenced by the enthusiastic praise bestowed on them by the *Times* on its editorial page, a few days ago.

The Subway Question in Paris. PARIS has so often been held up as the example of what can be done in the way of operating electric wires under ground, with the result of imbuing the minds of the uninformed with the idea that the problem had been completely solved there, that it seems appropriate at this time to examine more closely into the exact state of affairs existing in that city to-day, and more particularly with respect to electric light wires. It is a well known fact that many telephone and telegraph wires have been placed in the large sewers of Paris and have worked with satisfaction for some time; but it is not to be forgotten that a great number of these wires still run overhead there and are likely to stay up, in view of the overcrowded condition of the sewers, as described in another column. Moreover, there are no arc light lines either underground or overhead in Paris, for, with the exception of a few isolated arc plants in public resorts, there is no arc lighting in that city, the whole number of lamps in operation nightly probably not exceeding one hundred. The distribution of current for incandescent lighting is just about to begin, and the companies, on account of the crowded condition of the sewers, and their inadaptability to a general house to house distribution, are even now looking about for a good underground system to use. Here, then, is a state of affairs quite different from what many interested in this question may have been led to believe existed in Paris, and showing that we in this country must work out our own solution of the problem, so far, at least, as arc light wires are concerned, when considered as a system of *distribution* in the true sense of the word. Hence it would seem to be the part of wisdom to make haste slowly in placing wires underground, so as not to involve the outlay of a large sum of money in what may with the lapse of time prove inadequate to the demands of the service. The action of the municipal authorities in the large cities should be specially conservative, as their doings are likely to be closely copied by smaller communities. As a proof of this we have in mind the case of a suburban town whose city authorities had become infected with the underground fever, and contemplated passing an ordinance compelling the burial of the telegraph wires running through two or three streets and the wires of a 150 arc light station, the majority of the lights being city street lights. When informed that such action would probably lead to the closing of the telegraph office and the shutting down of the electric light station, the continued maintenance of which would become unprofitable under the proposed conditions, the project was promptly dropped and never heard of again. The lawmakers in our large cities therefore assume double responsibility in this matter, in that they not only dictate directly to their own constituents, but indirectly to the millions of residents of other smaller cities, who follow closely the precedents established by them.

The Centennial of Ohm.

To-day, March 16, is the hundredth anniversary of the birth of George Simon Ohm, to whom it is proposed to raise a statue at Munich, the capital of his native state, Bavaria.

The name of Ohm is so familiar to electricians, that we cannot hope to add anything to its brilliancy. Prof. Tyndall has justly spoken of him as "the Newton of the galvanic current," and his work may be said to have laid solid foundations for the science of electricity. His well-known law, that bears his name, finds universal application, and upon it many others have been established as sequences or corollaries. Ohm was perhaps not less a mathematician than a physicist, as is demonstrated in his "Mathematical Treatise on the Galvanic Circuit," in which "Ohm's law" is laid down. His eminent services to science won for him the Copley medal of the British

GEORGE SIMON OHM.

Royal Society, which is now co-operating with German scientific bodies in the movement to erect a statue.

We are glad to be able to present herewith a portrait of Ohm, who was born at Erlangen, Bavaria, on March 16, 1789, and died in his sixty-sixth year on July 6, 1854.

Prof. Rucker on Electrical Stress.

Prof. Rücker, at the Royal Institution, on February 16, delivered a lecture, in which he discussed the effects of the introduction of electrified conductors into non conducting or nearly non-conducting liquids. The subject had been studied by Faraday, Kerr, Quincke, W. Holtz and others, but various difficulties had prevented some of the more striking phenomena being shown in experimental lectures. The lecturer and Mr. Boys last year devised a set of apparatus which made the exhibition comparatively easy. Faraday's magnetic lines of force could be shown by the aid of iron filings: but the corresponding experiment in the case of electrical lines of force in a liquid was more difficult, because the liquid was thrown into violent agitation, and the solids used tended to cluster about one of the poles. These points were illustrated by experiment, and the lines of force were realized by means of powdered antimony immersed in ether. The tendency of the lines of force to become shorter, and to separate the one from the other, was also illustrated, and from this the fact was deduced that a body subject to electrical stress assumed temporarily a kind of crystalline structure. Kerr's and Quincke's experiments on the passage of polarized light through carbon bisulphide were then discussed. Kerr's experiments depended upon the fact that since the electrical stress was a tension along the lines of force, and a pressure at right angles to them, a substance in which such a stress was produced assumed a semi-crystalline condition in the sense that its properties along and perpendicular to the lines of force were different. Light was therefore transmitted with different velocities according as the direction of vibrations coincided with or was perpendicular to these lines, and the familiar phenomena of the passage of polarized light through crystals might be imitated by an electrically stressed liquid. These researches were exhibited with various modifications and extensions.

A Miniature Battery.

BY I. H. FARNHAM.

Having occasion, at a recent hearing before a city government, to demonstrate, among other facts, something of the minuteness of an electric current which will suffice to be heard in a telephone, it occurred to the writer that the

A MINIATURE BATTERY.

current from a very small battery would more forcibly illustrate the fact than mere numerical quotations from electrical professors who have made a special study of the subject.

For this purpose a battery was constructed similar to that shown in the accompanying sketch. As will be seen, it consists simply of a small glass bead, through which is bent and returned upon itself a fine copper wire; and also through the same hole in the bead, but on the opposite side, a fine iron wire. On inserting in the remaining aperture a minute drop of acidulated water, a current of sufficient strength will be produced to be plainly heard on listening at the telephone. By means of such a minute battery, signals were transmitted over more than 200 miles of wire.

Of course to an electrician this may be less wonderful than other experiments which may be performed by larger batteries, and by using with them resistance, or other means of finely dividing the current or preventing its flow. Should your readers repeat the experiment, it will please them.

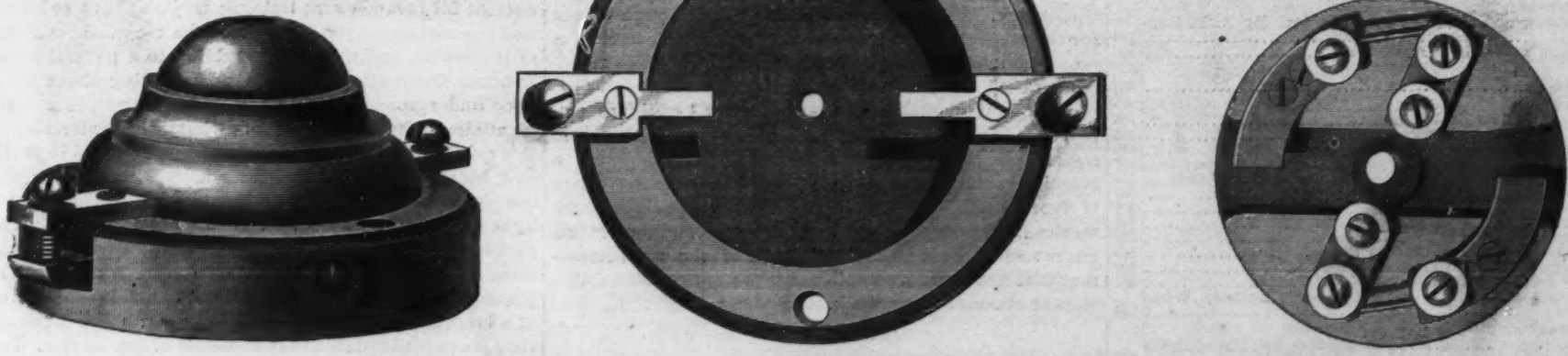
A drop of water containing sal ammoniac, or any other exciting fluid may be used as a substitute for the acidulated water.

Winding Clocks Electrically.

Experiments have been carried on by the Eastern Railway Company of France, with the system devised by M. Pouchard, for automatically winding up the clocks at the stations electrically. A small electric motor supplied with current from two Leclanché cells effects the winding, and is put into connection three or four times a day by the clockwork.

The "K. & W." Cut-Out.

The accompanying illustrations, Figs. 1, 2 and 3, will give the reader an idea of the new "K. & W." cut-out, jointly invented by J. L. Kimball and H. C. Wirt, both of Boston, Mass. Fig. 1 shows the cut-out when intact and ready for use. It is made in two parts, and is fastened together by two brass contact pieces, one on the cap and the other on the base, as shown in Figs. 2 and 3. Fig. 2 shows the upper face of the removable cap which contains the double-pole fuse wires to which the flexible cord is fastened. Fig. 3 shows the inside of the base with the binding posts for the main wires. Messrs. Pettingell, Andrews & Co., Boston, Mass., are the sole agents for this cut-out.



FIGS. 1, 2 AND 3.—THE "K. & W." CUT-OUT FOR ELECTRIC LIGHT CIRCUITS.

Electric Distribution in Paris.

In a recent article discussing the conditions of electrical distribution in Paris, Mr. J. Laffargue describes the condition of affairs as they exist there at the present time. Thus the electric light station, situated in the Cité Bergère, has overhead cables, and the station in the Faubourg St. Martin also employs overhead wires, but the new companies who have just obtained concessions will only be permitted to install underground lines. The sewers, however, have finally been reserved for the cables of the municipal service. This is perhaps not an advantage, according to Mr. Laffargue, if we consider that cables although fixed under protecting coverings such as mouldings may be at the mercy of those who work in the sewers, and are exposed to dampness, and to several other deteriorating influences. M. Laffargue also points out that the sewers of Paris are even now heavily encumbered with telephone and telegraph cables, water pipes and pipes for the distribution of compressed air. The accompanying engraving from *La Nature*, shows a section of the sewer in the Avenue De L'Opéra. At *A* is a water pipe, one metre in diameter; *B* and *C* are two water pipes 10 centimetres in diameter; *D* is a pipe for the distribution of compressed air, 20 centimetres in diameter; *E* represents several thick bundles of telephone and telegraph wires; *F* is a tube for

THE SUBWAYS OF PARIS.

conveying compressed air to pneumatic clocks; and to these must be added the pipes which serve for the pneumatic post in Paris.

It will thus be remarked that a large number of conductors are already used. M. Laffargue therefore considers it very probable that the sewers will not be used for the coming installations. The different electric light companies are even now looking about to find something in the conduit line in which to place their cables as advantageously as possible.

Progress at the Deptford Ferranti Station.

The large transformer station, on the Ferranti system, at Deptford, is now the point of attraction of all eyes in the electrical world, and all are anxiously awaiting the start with a similar feeling to that often enough experienced by electrical engineers in the early days on the starting of a new installation. "Lighting up" is a common enough event now, and we know exactly what to expect, but the arrangements for lighting up here are of sufficient grandeur and novelty to bring the same feelings into play again. We are pleased to be able to report, says the London *Electrical Engineer*, that the work at Deptford is actively progressing. The roof has been on some time, and the two "small" engines of 1,500 h. p. each are laid down. Boiler-power to the extent of 6,000 h. p. is ready, but the dynamos and electrical connections will not be placed till the last, when the building is dryer. None of the 10,000 volt mains have yet been laid. This, however, will not be a long job, and will be done in as short a time as possible, so as not to inconvenience the railways along which they are to be run. Arrangements are made for a start about the end of April, and the wires will first be led to Charing Cross distributing station, and connection made from there to a large number of houses to the number of many thousands, which are already wired for the light. The machinery at the Grosvenor Gallery will not be disconnected for some little time, till the outstanding needs have been fully supplied.

The Edison Central Station at Easton, Pa.

The Edison Electric Illuminating Company, of Easton, Pa., was organized in October, 1888, with a capitalization of $50,000 by Messrs. Walker & Kepler, general agents of the Edison system in Pennsylvania. Mr. H. G. Tumbler is the president of the company, and Mr. Howard Rinek the secretary.

Immediately after the organization of the company, prompt steps were taken to obtain an early construction of the central station and system of distribution. All the electrical engineering and steam engineering plans and specifications were prepared by the Engineering Department of the Edison Electric Light Company under direction of Mr. J. H. Vail, and contracts were immediately entered into with the various contractors for each department of the construction. The steam plant was erected by Messrs. E. P. Hampson & Co., of New York city; the electrical work in the station and the installation of the meter system was done by Messrs. George F. Sandt and H. T. Edgar, of the Engineering Department of the Edison Electric Light Company. The building is two stories high, occupying a ground area of about 30 × 90 feet. The walls are brick, the floor of the dynamo room is concrete and the ceiling corrugated iron, thus making the building almost entirely fire-proof, no wood-work being used in either the dynamo room or the boiler-room excepting for door and window casings. The building is two stories in height, the second floor above the dynamo room being occupied as a storage room, work shops, manager's office, show room, meter department, etc. The show room is fitted up very tastefully and contains numerous handsome electroliers and a sample of each of the various appliances such as cutouts, switches, moulding, cleats and other details used for wiring of buildings. The meter room is fitted up in hard wood and the cases and shelves are of polished white oak. The office is handsomely fitted up, brilliantly illuminated, and nicely furnished.

The station was started on Saturday, Jan. 26, 1889, having a capacity of 2,000 16 c. p. lamps, with 1,600 burning lights connected. The works are situated near the foot of Ferry street on the Lehigh River, giving much advantage to the company in receiving their coal supply and also their water supply. The steam plant has many features of novelty in its construction, and it is of the best character of materials and workmanship throughout. It consists at present of two horizontal tubular boilers of 100 h. p. capacity each, one of the new type combined feed water heater, purifier and exhaust muffler, as manufactured by the National Pipe Bending Company, of New Haven, Conn., one Hoffman damper regulator, 1 water separator, two 18 × 12 inch Armington & Sims engines and 4 Edison dynamos of 500 16 c. p. lamps capacity each. The steam and exhaust piping in the engine-room is laid under the floor. The only visible connections to the engines are polished copper bends leading to the throttle valves. There is a space left for two more engines and four more dynamos of 750 16 c. p. lamp capacity each, thus giving a total ultimate capacity in the station of 5,000 16 c. p. lamps.

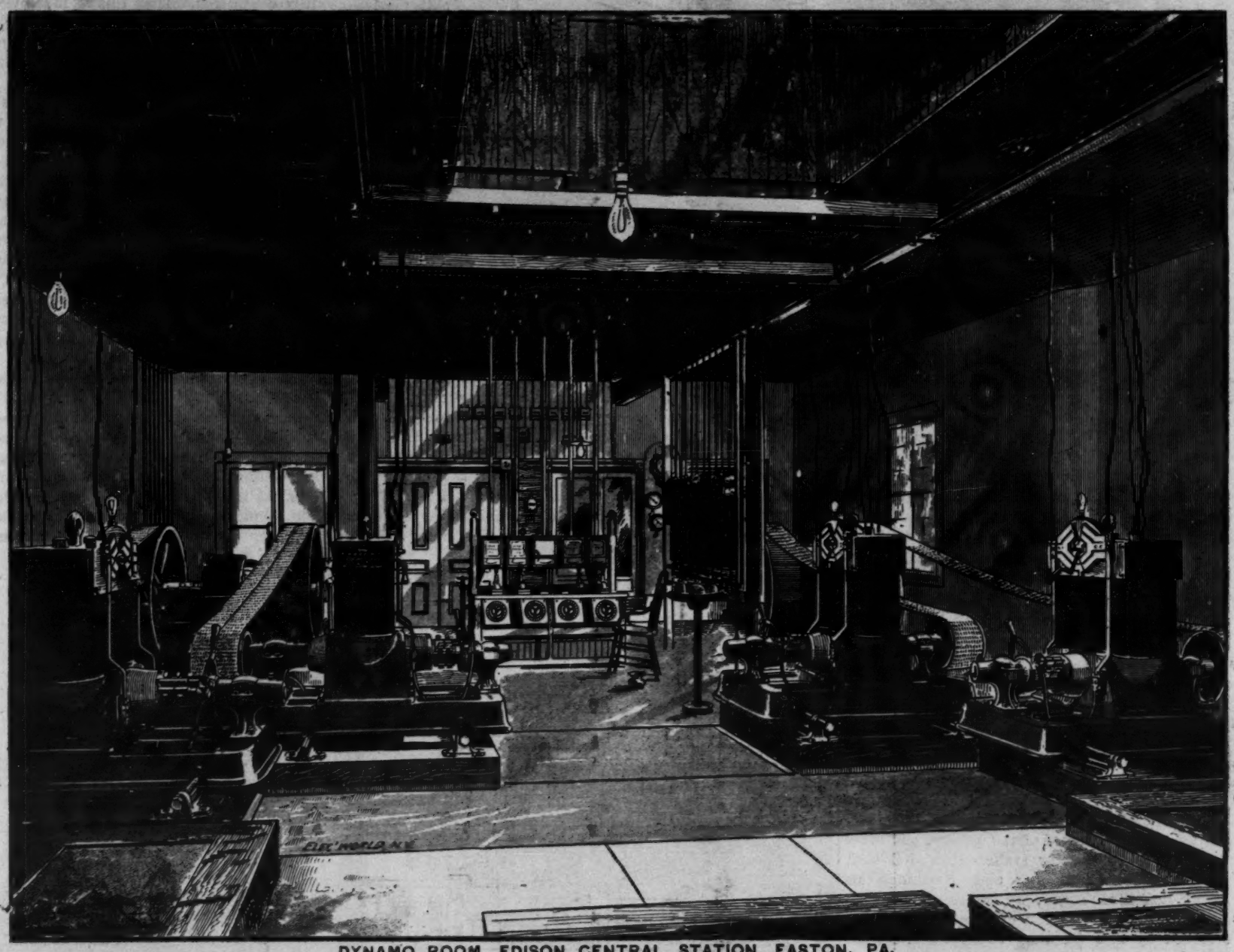
The electrical appliances are of the latest design as manufactured by Bergmann & Co. In their placing and construction several new features have been introduced, most of the regulating apparatus being contained on the regulator stand which is a novel piece of work in many particulars giving great convenience for the manipulation of the station. This regulator stand is placed in the end of the dynamo room between the engines, and on it are the dynamo regulators, dynamo ampère meters, dynamo switches, and other regulating and indicating apparatus, so that one man without leaving his position may conveniently manipulate all the dynamos and the entire electrical department of the station, throwing them in or out of circuit as required. In front of the regulator stand, over the door leading from engine to boiler room are the dynamo galvanometers and pressure indicators. There are at present five feeders, each supplied with ampère meters.

In the electrical details of the system of street conductors, there are several novel features, one of the most important of which is that the system is automatic in its regulation of electrical pressure, no feeder equalizers being used. A careful test of the electrical pressure at a large number of points throughout the system showed absolutely no variation in E. M. F. thus making it possible to use lamps of one common voltage throughout the system each lamp receiving at all times its constant pressure to give proper candle power.

Special attention should be called to the arrangement and construction of this station as embracing a very considerable feature of economy in the utilization of the real estate. We here have a station eventually comprising four large boilers, four engines and eight dynamos, whose ultimate capacity will be 5,000 16 c. p. lamps, occupying the space within the walls of a building whose outside dimensions are 30 × 90 feet.

The convenient arrangement of all the apparatus is one of its most commendable features. Too much credit cannot be given to Mr. Howard Rinek for the prompt and efficient manner in which he has pushed and superintended the construction of the work and establishment of light among the business men of Easton. Mr. Rinek's great interest in electrical matters and his standing as a shrewd business man ably fit him for the position which he occupies with the company.

The company as above noted started off with 1,600 lamps connected, and serving 125 customers on the meter basis. Since the date of starting, applications have been continually coming in to the company for the incandescent light, and it will be but a very short period before the entire present capacity of the station is taxed to its utmost and the increased capacity of additional boilers, engines and dynamos will be ordered.



DYNAMO ROOM, EDISON CENTRAL STATION, EASTON, PA.

The Slow Baking of Dynamo Armatures.

BY R. H. STERLING.

In reading the very interesting article in THE ELECTRICAL WORLD of Feb. 23, on "The Burning Out of Armatures," by H. Franklin Watts, I find that he omitted one fact that is the cause of as many armatures burning out as his very true theory, that of mechanical defects; and that is the carbonizing and consequent lowering of the insulating property of the organic matter composing the insulation. For instance, take a new armature just from the factory, insulated with the universal cartridge paper and shellac, showing a resistance way up in the megohms; how long is it going to stand this daily baking it receives without carbonizing? To be sure an armature should be so designed that it will not heat, but the best will do this under certain conditions. The shellac itself in a short time seems to entirely disappear or evaporate from the once thoroughly saturated paper. This raises the question, Why not use some substance for the insulation of armatures that does not possess this defect, and what is better for the purpose than mica and asbestos paper? Don't let the high price of the former, and the work of glueing it into sufficiently large sheets, prevent us from having the element of reliability in our armatures. It has the disadvantage of not being sufficiently pliable for some forms of armatures in making sharp bends, but a closely-made asbestos paper could here be used; and if a liquid insulation must be applied, copal varnish or boiled oil will be found far preferable to shellac. If insulating bushings and blocks *seem* large enough for all practical purposes, make them still larger, so as to be sure they are safe. There is no excuse for the field coils of a dynamo ever burning out; they do, however, and just from these simple remedies being ignored.

I had occasion not long since to "nip in the bud" the commencement of a burn-out in an armature before all trace of the cause was obliterated in the charred remains, and, at the same time, substantiating Mr. Watts' theory.

The armature, one of an alternating type, had become grounded on the core, and on removing the wire I found that the insulation in a small spot was completely worn through, evincing all the signs of mechanical abrasion and only needing another such a contact to short circuit and burn out the armature. In this armature all that impelled the wire coils were wooden cleats at the ends and the binding wires on the circumference, but how completely these were effectual the sequel showed; for on receiving a short circuit on the lines one day, the wire on one of these armatures remained behind, while the body kept on revolving until everything became clogged up in the pole pieces, and stopped the engine. I have since remedied these defects by screwing to the core the hard wood slats used to separate the ten coils from one another on the circumference. This gives a rigid and broad surface to carry the coils around in unison with the core, which seems especially necessary in an armature of the alternating type where the rapid changes in polarity must set up a decided vibration tending to cause mechanical injury to the insulation, unless the consequent friction can be eliminated by rigidness of construction, as Mr. Watts has pointed out. When parent companies begin to look into details a little closer for the cause of the failure of their armatures, and, above all, profit by the experience of the users of their apparatus, who are the sufferers, and from their experience, where they have been enterprising enough to do their own repairing, can give these parent companies some valuable points, then will these pyrotechnic displays in our dynamos be a thing of the past and confidence reign supreme in *this* part of the plant, at least.

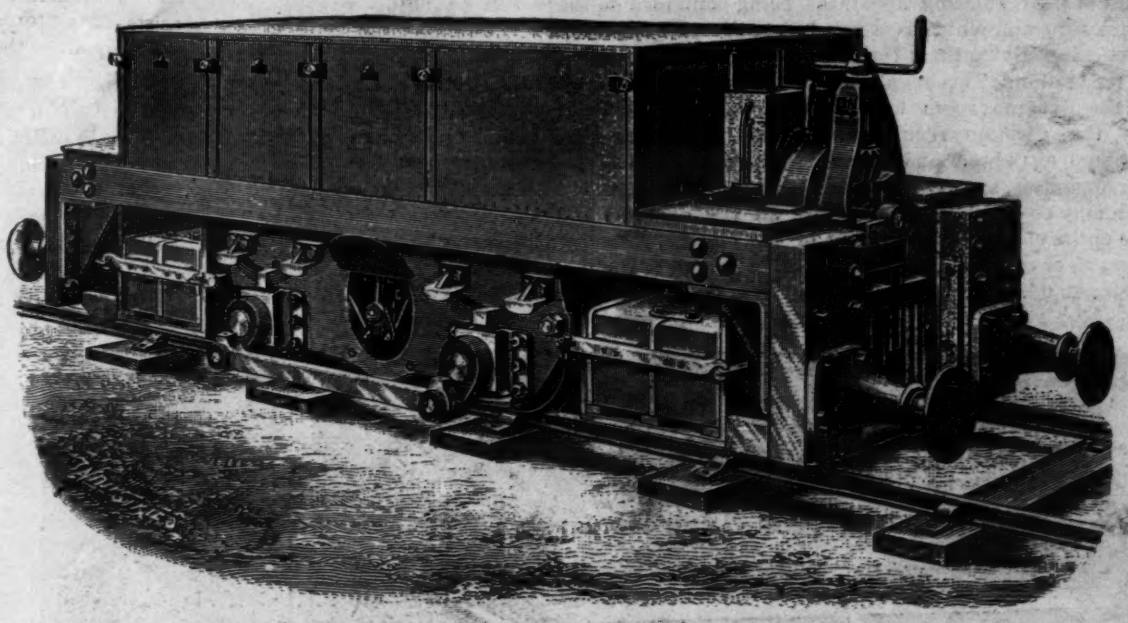


FIG. 1.—THE IMMISCH STORAGE LOCOMOTIVE FOR MINES.

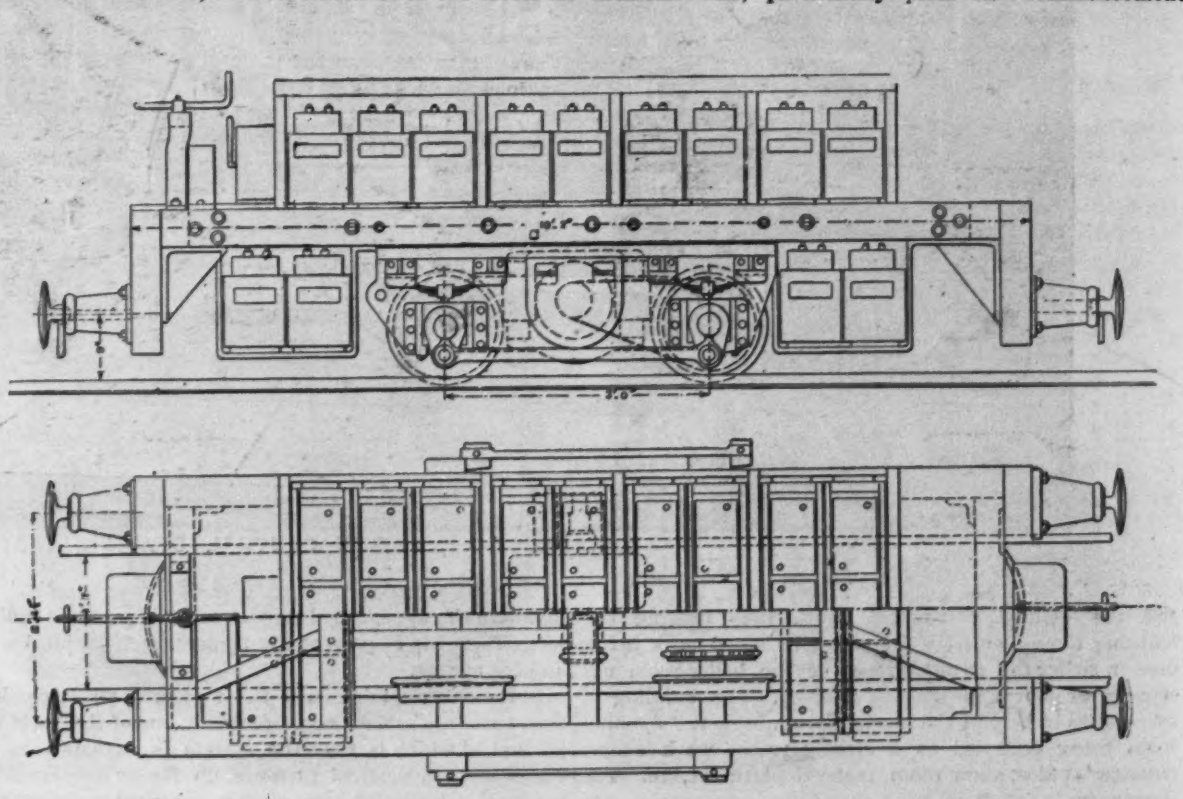
Immisch Electric Locomotive for Mines.

The application of electricity as a motive power in mines is not a new departure. Some years ago Messrs. Siemens and Halske constructed an electric locomotive for the Zankerode mine, the current being supplied by conductors supported from the roof of the gallery, and other installations on the conductor system soon followed, among them that of Schlesinger and Sprague in this country. Mr. Reckenzaun was, we believe, the first to use storage batteries as the source of power, and a locomotive designed by him for the Trafalgar Colliery has been described and illustrated in our columns. The latest example of electric haulage in mines is also a locomotive carrying its own store of power in the shape of accumulators. This locomotive was built by Immisch & Co., for the Wharncliffe Silkstone Colliery to run on a 1 foot 9 inch gauge, and in a drift 4 feet high by 4 feet 6 inches wide, whilst its total weight in working order was not to exceed 2½ tons. Before entering upon a description of this locomotive, we may give the results of some trials which were made with it on a surface line at the colliery, by Mr. E. B. Walker, and communicated to the Midland Institute of Mining, Civil and Mechanical Engineers in December last. The line contained a short piece of level; 200 yards of 1 in 70; 150 yards of 1 in 40; 250 yards of 1 in 25; and 200 yards of 1 in 40. On the gradient of 1 in 70 the locomotive would just move a train of twenty loaded corves, weighing together 11 tons, and with fifteen corves, representing 8½ tons, a speed of three miles an hour was obtained, the current being 45 ampères at 100 volts pressure. On the gradient of 1 in 40 the maximum load was eight corves, and on 1 in 25 it was six corves, the speed being a little over two miles an hour. On the level the locomotive could draw thirty corves, the current being 45 ampères.

The frame of the locomotive, which is illustrated in perspective in Fig. 1 and in plan and elevation in Figs. 2 and 3, is supported on springs on axle boxes outside the wheels, and in order to secure a maximum degree of steadiness, four sets of storage cells have been suspended in front and rear of the wheels from the platform. The wheels are coupled by rods to fully utilize the weight for adhesion.

The storage battery consists of 44 modified Tatham cells, each box being 10 inches by 6½ inches by 11 inches high. The boxes are lead lined, and arranged in sections of three in wooden trays. Each box contains 19 plates, 7 inches by 4½ inches by $\frac{1}{16}$ inch thick, and has a capacity of 150 ampère-hours, the weight being 53 pounds. The rate of discharge varies between 35 and 50 ampères, and at starting rises occasionally to 65 ampères. Taking 40 ampères as the average rate, the weight of these cells per horse power works out to nearly 500 pounds; and per horse power hour storage capacity to 134 pounds. Messrs. Immisch are now engaged in working out several improvements, by which the storage capacity, as compared to weight, will be increased.

The motor, which is placed underneath the platform and between the wheels, is of the ordinary Immisch type. The armature is 10 inches diameter, and wound with No. 12 S. W. G. wire. There are 480 wires counted around the periphery, and the commutator has 48 sections. The resistance of the armature is .23 ohm. The field is of the double horseshoe type, and wound with No. 9 S. W. G. wire in two parallels, there being 560 effective turns. The resistance is .14 ohm, or total resistance of the motor .37 ohm. The normal current is 45 ampères, and the speed 1,000 revolutions per minute, with a terminal pressure of 100 volts. The weight of the motor is 4 cwt., and it gives 4 h. p. at 800 revolutions per minute. On the armature spindle is a small phosphor bronze pinion; this gears into four steel pinions, placed in the same plane, and 90 degrees distant from each other. These pinions are bushed with gun metal, and run on steel pins carried on a cast iron disc. The disc revolves on a journal turned outside of the end of the motor bearing. Outside of, but in the same plane as these pinions, is fixed an annular casting of gun metal with teeth cut on the inside. The steel pinions gear into the ring, which forms a fulcrum on which they revolve when the motor spindle turns. The power is transmitted from the cast-iron disc by a sprocket pinion keyed to it on the inside next the motor, and a steel chain connects this sprocket pinion to a suitable wheel mounted on one of the axles, whilst the other axle is connected with this by the coupling rods already mentioned. The direction of motion is reversed by a switch, which reverses the magnetization of the field, and the speed is regulated by iron resistance coils. A brake is also provided. The current for charging the battery is furnished by an Immisch dynamo, which is driven by belt from a Willans engine.—*Industries.*



FIGS. 2 AND 3.—ELEVATION AND PLAN, IMMISCH MINING LOCOMOTIVE.

Iron Sheathing and Speed in Long Cables.

To the Editor of The Electrical World:

SIR: Having read with interest your editorial article in last week's issue upon "Iron or Hemp-covered Cables," and in which some doubt is expressed as to the certainty of the conclusions arrived at by Sir William Thomson, regarding the effect of iron sheathing on the speed of signaling through long cables, I beg to submit to the consideration of your readers a fact which seems, as evidence upon this point, to have escaped consideration.

In the application of the duplex system to long submarine cables it is always admitted that the artificial line should be the exact representation of the actual cable in respect to resistance and electrostatic capacity, both singly and jointly considered. That this is, moreover, the true representation of the case is proved by the fact to which I can personally testify, that there is more than one case on record where the artificial lines having been made with great care as faithful copies of the cables for which they were prepared, were found on application to balance them for duplex immediately with little or no adjustment. Of course this is not the general experience, and much time is sometimes required to adjust an artificial line before balance is obtained, but this is always found to be due to imperfection in the imitation of the cable's resistance and capacity, and the principal must, on due examination, be admitted that a perfect artificial line would be a perfect counterpart of the resistance and capacity in the actual cable, both individually as well as in their mutual relationship. This is equivalent to the assertion that a long cable sheathed with iron may be balanced for duplex by an equally long imaginary cable of precisely similar core, but no iron sheathing. Hence it follows that there is no appreciable effect of electro-magnetic induction, for if it existed, it is evident to anyone who has measured electro-magnetic induction, that in order to obtain balance between duplicate actual and artificial cables it would be necessary to insert a corresponding amount of electro-magnetic capacity in the latter, or what in this case would be an equivalent resource, to diminish the electrostatic capacity of the artificial line, particularly near its commencement. Hence the acknowledged coincidence in the proportions of resistance and capacity throughout the nearer sections of actual and artificial cables conclusively proves experimentally the results obtained mathematically by Thomson, Heaviside and Charles Hockin, to the effect that the iron sheathing of long cables has no depreciatory influence on their speed of transmission.

On the other hand, it is well known that very short cables worked at high speeds when balanced for duplex require less electrostatic capacity than a perfect imitation in their artificial line would demand, and this may perhaps be due to the effect of electro-magnetic capacity from the influence of their sheathings under those conditions of high speed and comparatively small retardation.

A. E. KENNELLY.

EDISON LABORATORY, Orange, N. J.

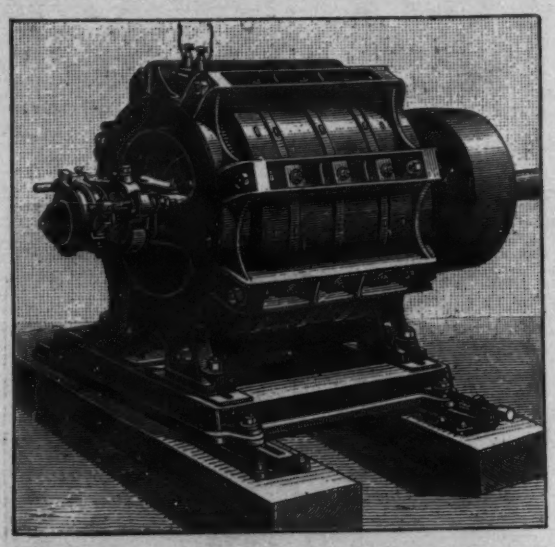
Electric Lighting in Dieulefit and Valreas.

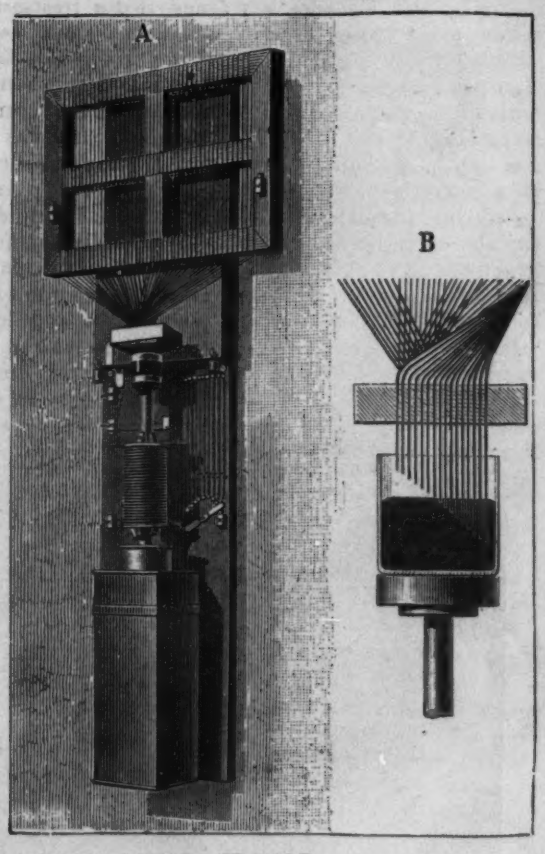
In a recent number of *La Nature* M. Hospitalier describes a most interesting plant which has been recently put into operation for the purpose of furnishing electric lighting for the villages of Dieulefit and Valréas, France. Being situated in the mountainous districts, these villages until recently possessed no public illumination whatever.

FIG. 1.—ZIPERNOWSKI-DERI-BLATHY ALTERNATING CENTRAL STATION, BECONNE, FRANCE.

The difficulties of transportation in these parts and the small population rendered it almost impossible to establish gas works, and the individual establishment of an electric light station by each town would not have paid. The problem has been solved by the two towns combining to utilize at Béconne a waterfall distant, respectively, five kilometres from Dieulefit and 14 kilometres from Valréas, and by the erection of a single electric light station for both. The Zipernowski-Deri and Blathy system of distribution by transformers is employed. The central station placed at Béconne derives its power from the water brought in by a canal and the water is run into a reservoir having 13,000 cubic metres capacity, and which is sufficient to equalize the variation in the quantity and pressure and affords at the same time a certain reserve of power in case of the accidental rupture of the canal. The available fall at the turbines is 25 metres (about 80 feet) and the reserve of water represents about 1,200 horse-power hours gross, or about 800 electrical horse-power available for lighting. The water from the reservoirs is conveyed through two conduits of wrought iron, $\frac{8}{10}$ metres in diameter, and which lead directly to two horizontal turbines of 50 h. p. each, which make 180 revolutions per minute. Each of these turbines drives an alternating machine with a capacity of 24,000 watts, *i. e.*, 12 ampères at 2,000 volts. This machine is shown in the accompanying illustration (Fig. 3). In addition to this each turbine also drives a shunt-wound dynamo, used as an exciter and having a capacity of 30 ampères at 80 volts. Each of the towns is furnished from a separate group comprising a turbine and an alternating machine and exciter. The reserve consists of a dynamo of the same type and will be ultimately completed by the addition of a third turbine similar to the two others.

The speed of the turbines is maintained constant by means of a hydraulic regulator, which, though efficient, is nevertheless insufficient to maintain a constant difference of potential on the line at the points of distribution in the two towns, since the resistance of the lines is 14 or 15 ohms, which with a maximum current of 12 ampères represents a drop in potential of about 180 volts. A very ingenious and efficient system of regulation compensates for this variation in the pressure, no matter what may be the load. The general principle is the following: The lamps which light up the station at Béconne are fed by a special transformer, the primary circuit of which is placed in a shunt to the main switch-board close to the terminals of the generating machine. A small special transformer, called a *potential equalizer*, has the object of reducing the current which traverses the primary circuit of the station transformer in the same ratio as that which traverses the line connecting the station to the village to be lighted. Under these conditions, when the works are well regulated the condition of the lamps at the station is a perfect reproduction of that of the lamps at the village, notwithstanding the difference in pressure on the line due to its resistance. It is, therefore, only necessary to maintain the difference of potential constant between the lamps at the station in order; also to maintain them constant at the terminals of the distant town, and thus establish perfect distribution. This is accomplished by means of an automatic regulator shown in Fig. 4., which acts on the field of the exciting dynamo that delivers its current to the magnets of the alternating machine. For this purpose a solenoid is connected in shunt to the station transformer, and acts upon a tube of soft iron which is movable vertically in the centre of the solenoid and is maintained in equilibrium by means of a float which plunges into a rectangular box filled with water. The upper part of this soft iron tube is terminated by a glass trough containing mercury. Into this trough there projects a plunger of metallic rods of decreasing length, and connected with the different points of a German silver rheostat. The variations in the current which traverses the solenoid raise or lower the trough of mercury, and thus connect a varying number of rods, and consequently add or withdraw resistance from the exciting circuit. which, acting upon the generating machine, maintains the potential of the station lamps constant. The regulating system which we have just described is in duplicate, each of the towns having its independent machine, though in the same building.





FIGS. 2, 3 AND 4.—DYNAMO, REGULATOR AND ROOF DISTRIBUTION, DIEULEFIT AND VALREAS, FRANCE.

The lines are overhead, of bare wire, and placed upon poles and insulators of the double bell porcelain pattern. The shortest line between Béconne and Dieulefit consists of a silicon bronze wire 3,2 millimetres in diameter. The line from Béconne to Valréas consists of a "toron" of wires of larger section so as to better equalize the resistances. A telephone line consisting of complete metallic circuit is also part of the service, and connects the station with the two towns, so as to secure proper communication at all times. In both villages the primary wires are run on standards placed on the eaves of the houses, as shown in Fig. 2. The transformers, all of the 1500 watt type, are placed as near as possible to the centre of consumption, and are contained in zinc cages, which are fixed on brackets against the walls. The secondary wires coming out from the transformers are also overhead and bare, except where they are run into the street lamps or into houses, at which points they are carefully insulated. The interior wiring is entirely inclosed in wooden moldings, and the wires are not accessible at any point. All the auxiliary apparatus, such as brackets, cut-outs and switches are mounted in porcelain.

The transformers employed have a coefficient of transformation of 18; thus they operate with 1,750 volts on the primary and distribute at 95 volts at the lamps. The arrangement of the transformers is not the same at Dieulefit as at Valréas, and the different methods adopted are justified by the difference in the contour of the two towns. Dieulefit is spread out lengthwise, there being a distance of 5.3 kilometres between the two extreme lamps. In order to equalize the distribution it has been necessary to couple all secondaries upon one continuous feeder, for without that arrangement the most distant point would be sensibly affected by the lighting or extinction of lamps nearer to the station. Valréas, on the contrary, forms an almost perfect circle, and the distribution constitutes a sort of "bouquet" distribution. Several distinct secondary groups have therefore been established, each being fed by three transformers. Each machine is able to feed twelve transformers at full load. Our illustration, Fig. 1, shows the station which contains all the machinery that lights the two towns.

The Knowles Method of Preparing Storage Battery Plates.

In a patent just issued to Mr. Edward R. Knowles, the electrician, Brooklyn, L. I., the inventor describes a method of forming secondary battery plates which is said to overcome the difficulty experienced with the buckling of the plates, and by which the active material is rendered of such a nature as to prevent scaling and the detachment of the plugs. The metal grid is made of an alloy of lead, antimony and tin. The active material is prepared by taking pure red oxide of lead and treating it with a strong

solution of pure sulphuric acid in water, of from 15° to 30° Baumé, until all that portion of the oxide which it is possible to be acted upon by the acid is sulphated. In this step of the process the quantity of acid solution should be such that all the acid will be used up in the sulphating action, leaving nothing but water. The result is then a mixture of sulphate of lead, peroxide of lead, and water. This is dried until of the consistency of paste, and is then pasted into the grid, forming the positive plate. If, however, it is not desired or required to paste the grids immediately, the paste may be dried, pulverized, and stored until needed. When required for use, however, it should be moistened with water to bring it to a pasty condition. The negative plate is formed by treating the yellow oxide of lead in the same manner, the resulting paste being the sulphate of lead, which is pasted into the grid. The plates are then allowed to become thoroughly dried and set.

The next treatment is a pickling process, and this is performed as a supplement to the above-mentioned sulphating process for the purpose of completely sulphating the oxide. Mr. Knowles has found that a treatment of the dry oxide with a solution of sulphuric acid cannot completely sulphate the oxide, for the reason that the oxide when pulverized (and this is its condition when submitted to treatment) is more or less lumpy, each particle being made up of a number of molecules and the acid acts only on the surface of the lump, leaving a core of oxide not sulphated. When the paste is worked over and rubbed into the plates, these particles become divided and expose molecules of oxide which have not been affected by the acid. Furthermore, the pickling process also serves to cement or bind the mass of paste into a more solid and homogeneous body. The process is as follows:

Both plates are slowly and carefully immersed in pure water and allowed to remain therein until they are wet through. They are then drained and immersed for some time in a weak solution of sulphuric acid and water. Next they are transferred to a similar solution, but somewhat stronger. After soaking awhile they are immersed in a strong solution of the acid and water. Here the plates are allowed to remain for a considerable time. They are finally drained and allowed to dry, when they are ready for forming.

This pickling process may be carried out by mounting and connecting the plates temporarily in groups of a fixed number of positives alternating with a fixed number of negatives. For instance, a nineteen-plate cell would contain nine positives and ten negatives, there always being a negative on the outsides of each cell. These sets of plates are then treated in the manner already described, that is, with solutions of graduated strength, and finally dried. Before forming, the plates are again soaked in acidulated water and then formed in the usual manner. If after the plates are pickled it is not desired to form them immediately, they may be dried and stored until needed. When they are mounted to be formed, however, they must again be soaked in acidulated water before being placed in the forming cell.

Plates made in the manner described remain, according to the inventor, perfectly flat and true, become thoroughly and perfectly formed, do not scale or buckle, and do not allow the active material to become detached. The formed plates are porous and soft, and are of the proper color and consistency.

FIG. 1.—CLIMBING THROUGH THE DEEP SNOW, BEACON STREET, BOSTON, MASS.

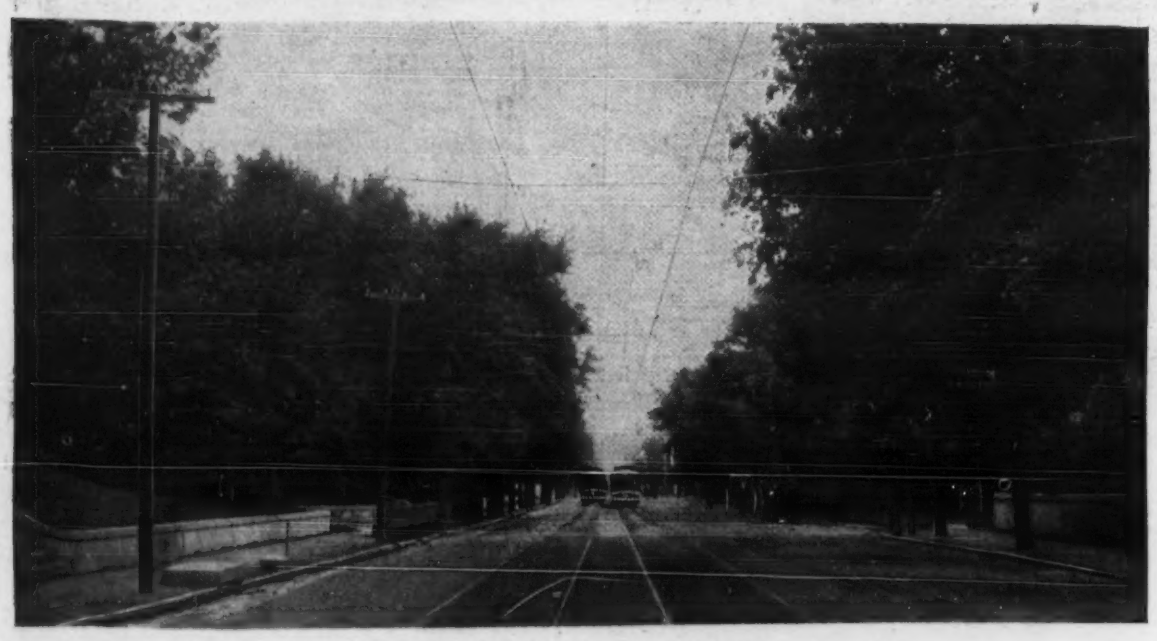
The Sprague Roads at Boston, Mass., Hartford, Conn., and Davenport, Ia.

We have so often made reference to the Sprague West End road that little can now be added. Interest will be taken, however, in the accompany view, Fig. 1. It shows one of the cars on Beacon street, near Coolidge corner, and was taken just after a snow-storm, in which the cars, without the aid of a snow-plow or other device, made their way through nearly a foot of snow without trouble or difficulty.

Fig. 3 shows the Davenport Central Railway, of Davenport, Ia., of which Mr. W. L. Allen is president. It was installed about three months ago by the Sprague Company, and operates eight electric cars. The grades on this line are some of them extremely long and severe, and they required, when mule power was used on the line, a company of four mules to each car. Since the introduction of electric motors the road has been running very successfully, and the gross receipts of the road during the months of September, October, November and December of 1888 average more than 60 per cent. increase over the gross receipts of the corresponding months of the year before. The directors and president of this line express themselves very well pleased with the operation of the road. During a heavy blizzard last month the road was operated by the electric cars very successfully, and being one of the first experiences of an electric railway in a snow storm, the successful operation of the cars attracted much attention of the street railway men all over the country, and added very much to the high opinion of confidence in the reliability of an electric railway among the street railway men.

FIGS. 2.—SPRAGUE ROAD, HARTFORD AND WETHERSFIELD, CONN.

The electric railway illustrated in Fig. 2, as in operation at Hartford, has been running about three or four months, and connects Hartford with Wethersfield, about three miles away. The overhead system in use is the regular Sprague, and it is considered a success by the citizens of Hartford.



FIGS. 3.—SPRAGUE ROAD, DAVENPORT, IA.

Prize Competition of Electricity Meters.

We have already mentioned the competition organized by the Paris Municipality with the object of solving the meter difficulty in small electric light installations. The conditions under which this competition will be held have now been specified, and the following prizes are offered: 10,000 francs will be awarded to the inventor of a perfect meter, and five prizes of 2,000 francs to the inventors of the next best meters. Generally speaking, the meters must be equally applicable for direct and alternating currents; but if only applicable to one of these, and otherwise fulfilling the conditions, half the prize only will be awarded. The Municipality of Paris reserve to themselves the right to manufacture and use any meter for which they have given a prize, free of royalty. The meters submitted will be examined, and the prizes awarded, by a commission of nine members, of which four will belong to the Executive staff of the Municipality; two must be Councillors, and three will be outsiders. These five will form the jury, and are MM. Mascart, Hospitalier, Potier, Vaillant and Lyon-Allemand. The following are the conditions to be observed by competitors: 1. The meters to be adapted for continuous, pulsating or alternating currents. 2. They must be capable of correctly indicating under varying pressure or varying current strength, or both, and should serve as

coulomb, volt-hour, or watt-hour meters. 3. They should be applicable to very small installations, and correctly indicate down to one 10 c. p. lamp. 4. Alternate current meters must indicate watt-hours. 5. The competitive experiments will be made with a view to more specially ascertain: (*a*) correctness of indication throughout the whole range of the meter; (*b*) minimum amount of energy consumed in the meter; (*c*) minimum of complication introduced by the use of the meter; (*d*) practical value of the meter as affected by its simplicity, facility for re-calibration and low cost. Those in this country who wish to take part in the competition may send their apparatus direct to M. Abdank-Abakanowicz, U. S. Electrical Section, Universal Exposition, Paris, who will make the necessary arrangements, etc.

DEPOSIT FROM LIVE STEAM PURIFIER, DAYTON, O.

The Purification of Feed-Water for Boilers.

Most of those who have to take any active part in central station work are familiar with the evils and losses growing out of incrustation in steam boilers. A forcible reminder of what impurities are contained in ordinary feed-water is afforded by the engraving herewith presented of a heap of lime deposits retained in a Stilwell live steam purifier in use on the boilers at the City Water Works, Dayton, Ohio. It is not an imaginary sketch, but is made direct from a photograph of the deposits obtained at one cleaning out of the purifier. But for the use of this purifier these deposits of lime would have been inside the boilers, and the great damage to the boilers and increased consumption of fuel it would have caused will be readily appreciated by all practical engineers. This purifier is manufactured by the Stilwell & Bierce Manufacturing Company, of Dayton, Ohio.

Vienna Soft-Cored Carbons.

A recent visitor to this country is Mr. M. Hardtmuth, of the Vienna and London firm of F. Hardtmuth & Co., which is well known in the European pencil manufacturing industry and is about celebrating its centennial. Of late years the firm have gone into the production of carbon points for arc lamps, as an adjunct of their large business, and their success with what are known as Vienna or Austrian soft-cored carbons is a matter of history, those carbons being in general favor in England and on the continent of Europe, where, we understand, Siemens & Halske have recently closed a contract for their use in large quantities. We were afforded an opportunity last week of witnessing a trial of some of these carbons in a number of Fort Wayne Jenney and Waterhouse lamps at the station of the Harlem Electric Lighting Company in East 122d street. The carbons there employed were uncoppered, but burned evenly and regularly on all sides. There was a remarkable absence of flickering and sputtering. It appears from tests made that these points also require less current strength for longer life. They are also entirely uniform in size and thickness. We should judge that for indoor and special service they are admirably suited, as one of the objections often brought against arc lamps in interiors is that the travel of the arc, etc., sometimes results in an uncertain light that is very trying to the eye, and somewhat trying to the temper. With the soft-cored carbons, however, the arc is maintained steadily in the crater, and hence the lamp burns with as little variation as an incandescent.

Since the trial at Harlem, other tests have been made elsewhere, in a thorough manner, and we are now informed that the Empire City Electric Company, of this city, will have the exclusive sale of these Hardtmuth carbons for this country, the department being placed under the care of Mr. H. D. Hall. In such hands the carbons will certainly receive the attention they deserve, and find their way to large numbers of consumers.

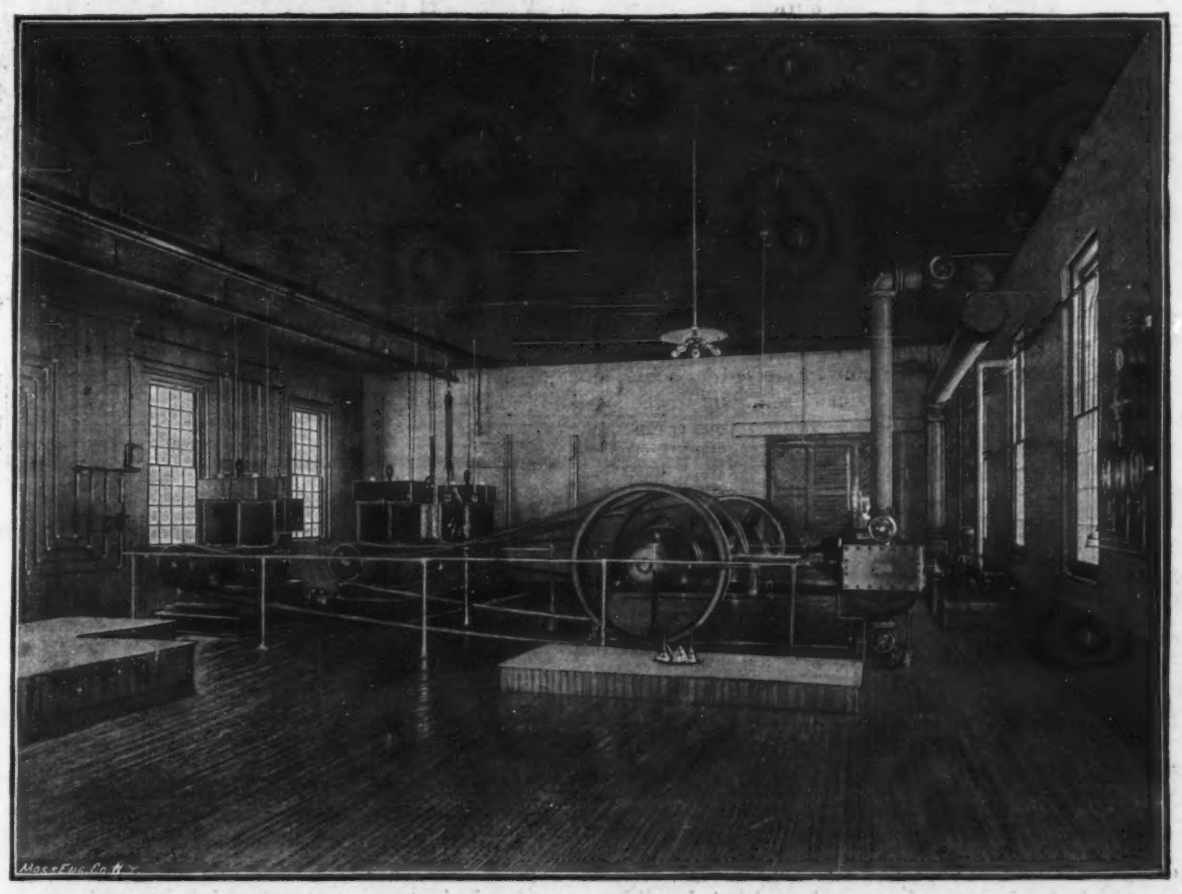
The Scranton (Pa.) Electric Power Station.

One of the most complete electric power stations for railway work is that belonging to the Scranton People's Electric Railway, of which we give an interior view in the engraving below. This power station supplies power for twenty cars, which are in operation in Scranton using the Sprague overhead system of wiring.

The dynamos, which are of the Edison type, are of 80,000 watts capacity each, and wound for a maximum electrical pressure of 500 volts. The power station is brilliantly lighted by electric lights from a number of handsome electroliers in groups of incandescent lamps, in fives, each group being controlled by an independent switch at the end of the engine room.

Although it may seem incredible, it is stated in regard to this station that it costs less to supply electric power to the twenty Sprague cars which are in operation in this city upon a line in which there are many steep grades than it would to keep one horse. The explanation for this is that the power station of Scranton is very near to a a pile of anthracite screenings, or "culm," as it is called, which may be had almost for the carting, and hence the expense for fuel at this station is practically nil.

The Sprague road at Scranton has been in operation now for about two months, and it is said to be giving very great satisfaction to the president and directors of the road, as well as to the citizens of Scranton. During the recent winter there were a number of severe storms in this city, but in spite of this the cars ran uninterruptedly, carrying large numbers of passengers, without hitch or break-down.



THE ELECTRIC POWER STATION, SCRANTON, PA.

Some Queer Joints.

BY C. MONROE DOTEN.

Probably 30 per cent. of the trouble experienced by various electrical fitters throughout the country arises from faulty line work, poor insulation or loose connections. Recently I was called to repair a bell circuit which extended between two buildings. Everything had worked for about a year, and within a fortnight the line had been broken and repaired by the owner who, by the way, disclaimed any knowledge of electricity. Everything about the battery seemed all right, but there was no current on the line. I examined that, and found that there were seven loop splices, like the sketch I send, in the whole length, and the latest one, made by the owner, was made with insulated wire *from which the covering had not been removed.* New splices of the usual style were substituted, and everything worked well. The original line, with its six odd splices, was put up by an amateur, who "knew it all."

Pure Air and Electric Lights.

The good or evil influence of the artificial light we use upon health is one of the highest importance, and it is strange, says the Chicago *Commercial Bulletin*, that heretofore so many of our prominent merchants have to a greater or less extent overlooked it in their homes and places of business. That ancient custom has so familiarized us with combustion as a source of light that, until within a few years back, we hardly ever dreamed there could be any other. Nevertheless, the introduction of the electric light has been opening the minds of Chicago people of late to the manifest advantages of a purer kind of illumination. Every merchant knows that pure air is what he seeks when, in the hot days of summer, he seeks the seaside or the mountain top for a few weeks of recreation. How important then is it that we should have pure air in our homes and places of business, where so much time is passed. The necessity that obliges so many of us to live in the city also obliges us to live in a more or less vitiated atmosphere and it is generally conceded that Chicago enjoys for the most part, about as vitiated an atmosphere as any city in the country. Pure air and light are essential to good health, but in close, ill-ventilated city offices, and in some, in fact many, of our wholesale stores, as well as in thousands of homes and workshops, what prospect is there for a pure air while the lights which are burned often half the day are of themselves polluting it? For not only does a candle, oil or gas flame waste the oxygen of the air, and thus rob it of its life-supporting virtue, but it actually soils it with noxious vapors, the product of combustion. These are chiefly water or steam and carbonic acid, but carbon-dust or soot is also thrown off, and in the use of the foul-smelling gas which the "Gas Trust" supplies our people, of sulphurous acid gas and other lights produced by combustion not only rob the air of its health-giving oxygen, but they adulterate what remains of it. Carbonic acid gas, which is supplied to the atmosphere from a flame, is, as every one must know, an active poison fatal to animal life. It is the "choke-damp" of the miner, and though always present in minute quantities in the atmosphere, it becomes dangerous when in excess. On the score of health alone

the introduction of electric light ought to be hastened as much as possible, nor should it be only the luxury of the rich, as a famous electrician, recently deceased, proclaimed it, but the necessity of the poor. Where purity and brightness are most needed, there purity and brightness should first come.

The Riley Elevated Electric Railway System.

Although the surface electric railway answers admirably for the ordinary requirements of intra-urban traffic and the speed obtainable by its means is greater than that which can be maintained by horses, surface roads are nevertheless limited in speed to a certain extent by obvious considerations. Hence where "rapid transit" is required,

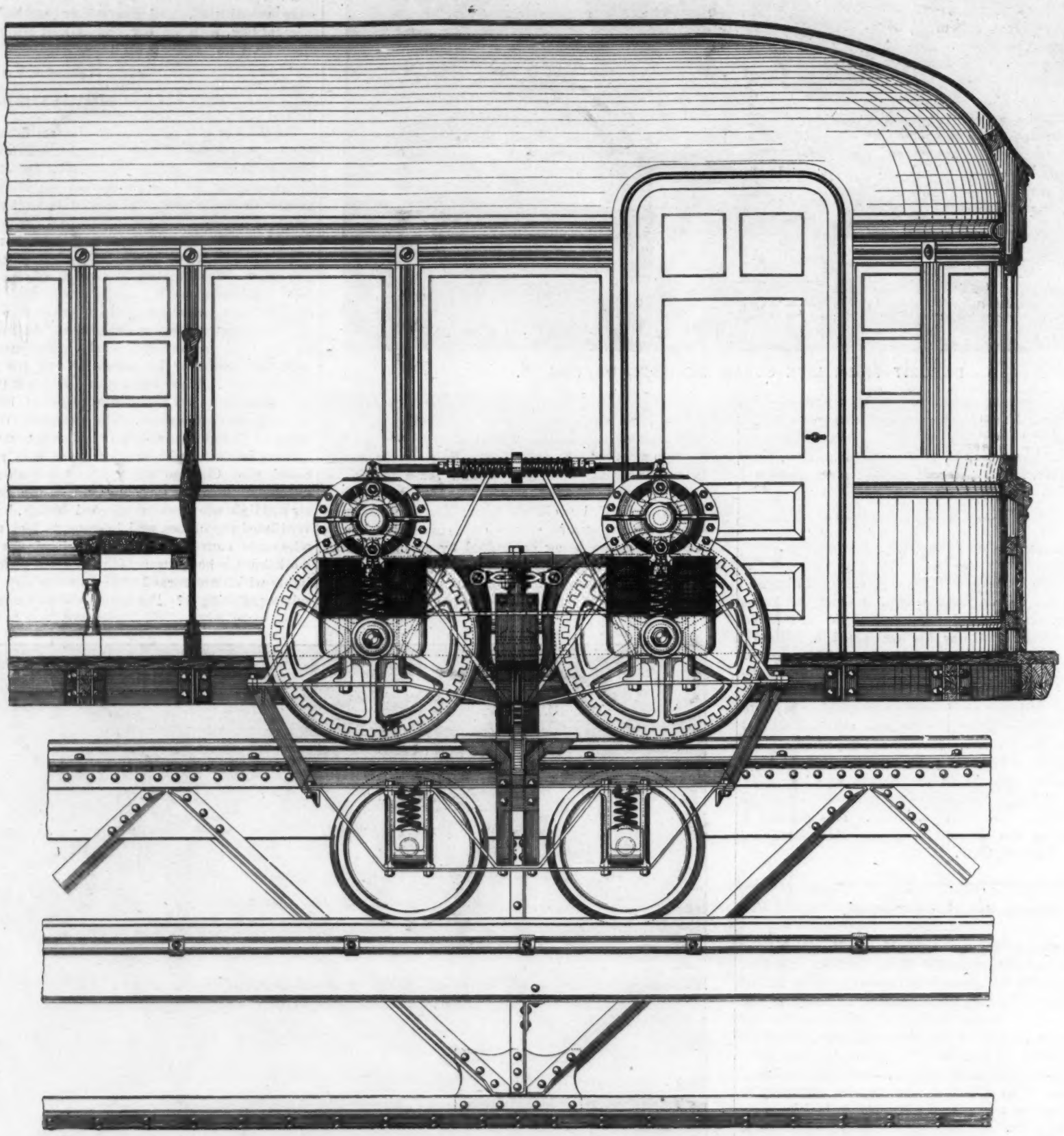


FIG. 1.—THE RILEY ELEVATED ELECTRIC RAILWAY SYSTEM—SIDE ELEVATION.

comparable to that on regular steam railways, recourse must be had either to underground or elevated railways. The great expense involved in the construction of the former makes their adoption very slow, and this consideration has brought the elevated railway, as exemplified in New York city, into prominence and favor as a means of quick communication between different points of a city and its outlying districts. As at present constructed, however, the elevated railways are open to many grave objections, such as the noise, oil and water waste, smoke, etc., and principally the obstruction of light and air which they entail.

To remedy these evils the Riley Railway Construction Company, of Boston, have recently completed plans for an elevated electric railway which demands attention. Our illustrations show a side and front elevation of a car and truck mounted on the proposed system. The road may be built either on the single or double post system, but the latter, for many reasons, is considered the better. The train runs on three tracks, the centre one being 28 inches above the other two. Each car has two trucks, each truck having six wheels. The centre or principal wheels of each truck tread upon the centre rail, one before the other, and are double flanged, while the side wheels are single flanged. The truck is centrally pivoted to the car-floor, and easily adjusts itself to curves of any practical radius, upon the same principle as the self-adjustment of the bogie truck. By a simple and effective arrangement of springs, the centre wheels will carry seventy-five per cent. of the load; the remaining twenty-five per cent. will be equally distributed on the side wheels, which, though not intended to do more than this service, are of ample strength to carry safely the entire car-load.

This car truck has much less machinery detail to keep in order than that of the truck in ordinary use upon railroads. It is strong, compact and light, and capable of passing around sharp curves with less friction than the old railroad truck, where the wheel base is greater and the axles are united.

Another advantage claimed for the Riley system is that by bringing the car floor down to within four inches of the centre rail the centre of gravity is lowered considerably. As the car floor is lowered, the centre wheels must come up into the car, but the space is not lost, as the seats are built back to back over them, the remaining part of the car having regular side seats next to the windows.

On account of its novel construction, the Riley system is especially adapted to the use of electricity as a motive power. It is intended to apply the electric power to both the centre wheels of the front truck of the forward car in a train of three cars as shown in the illustrations. The power car will be of the same length as the others, but eight feet of the forward end will be partitioned off for the motors and their devices for regulation. These will be on the truck, and will come up into the car; but as this truck is centrally pivoted, the motors will find no resistance in running upon curves of any radius. As the driving wheels can be of any diameter, it will be easy to fix on the size that shall give the speed desired on any particular road, with the best electric efficiency.

A Standard of Insulation.

To the Editor of The Electrical World:

SIR: I would like to ask the gentlemen of the Chicago Electric Club who have done so much with the difficult question of a standard of insulation to let the good work go on until a really reasonable and satisfactory value can be assigned for any specified case. I would suggest that the value of the unit of R be specified, as the ohm or megohm; also that L be specified, foot or mile. Taking R in ohms and L in feet, and applying Mr. Badt's formula to actual practice, gives so low an insulation that I am afraid it will never suit Mr. Haskins. Why is a lower insulation permissible in the case of the alternating current system? I ask because I want to know. Will Mr. Badt kindly tell us?

The "Dynamo Tough" who replaces his fuses with copper in order to feed his "grounds;" the New England Insurance Exchange with the magneto test; the Chicago city ordinance with its all-sufficient "megohm" requirement—all testify to the lack of agreement, and the variation in the "factor of ignorance," which exists regarding this very important matter. If such a state of things prevailed in civil and mechanical engineering we would have machines and structures such as Hafed saw in the "Land of Chance."

I object to the use of the factor of length in the case of parallel incandescent wiring, because no one ever knows the length of wire used in a large installation. Inside wiring will be sensibly proportional to the number of lamps, and by taking the lamps as a basis, guesswork will be eliminated, lying avoided and substantial justice done.

I regret that my absence from New York makes this communication so tardy. CHARLES WIRT.

ST. AUGUSTINE, Fla.

Voiding Edison Patents in Canada.

A special despatch from Ottawa, Ont., of March 7, says: "The incandescent electric lighting patent, held by the Edison Electric Light Company, has been declared null and void in Canada, on the ground of failure to comply with the patent regulations, which provide that the article thus patented must be manufactured in Canada within one year from the issue of the patent, and the importation of the same patent from the United States must cease within two years. This is the decision reached in the famous patent suit by Richard Pope, Commissioner of Patents, and his decision will be announced to-morrow. The appellants were the United States Electric Lighting and the Westinghouse Electric companies, represented in Canada by Ahearn & Soper, of Ottawa, and the Royal Electric Company of Montreal."

Some Figures on Electric Train Lighting.

At a late meeting of the New York Railway Club, Dr. H. R. Waite, of the Julien Electric Company, read a very interesting paper on train lighting. We extract the following:

Almost immediately after the equipment of the first express trains on the Boston & Albany R.R. running between Boston and New York, the Pullman Palace Car Company introduced the same system upon vestibule trains running between New York and Chicago, while the Pennsylvania Railroad at about the same time introduced it upon palace cars on their Philadelphia route. Following these equipments the Julien storage system was introduced upon the Connecticut River Railroad, the Grand Trunk of Canada, the Canada Atlantic, the Intercolonial, and later upon the Chicago, Milwaukee & St. Paul. That the system has not been introduced to a still greater extent upon American railroads is due to the well known fact that experiments have for a year and a half or more been going on with a view to such improvements as would secure all of the practical advantages of a complete isolated electric lighting plant for each separate train. It has from the outset been obvious that could this result be successfully accomplished the following advantages would follow:

1st. By generating the electrical current upon the train a supply for lighting and signaling, if desired, would be always available, thus avoiding the many difficulties arising from dependence for charging batteries upon electric lighting stations at terminals.

2d. All of the electrical arrangements would be under control of those upon the train, thus making it possible to secure more adequate attention to the conditions necessary to success.

3d. The amount of storage battery required would be greatly reduced, thereby avoiding the necessity of carrying so large an additional weight upon trains, as well as largely reducing the cost of installations and the cost of maintenance for each train.

Experiments in the direction of realizing the results above indicated, with the use of the Julien storage battery, were carried on simultaneously by the Julien Electric Company, the Pullman Palace Car Company and the Barrett Railway Electric Car Lighting Company.

The experiments made by the Barrett Company upon the Connecticut River Railroad were first brought to a successful completion by the use of a dynamo and engine placed in the baggage car of a train, the steam for running the engine being taken from the locomotive boiler. The train upon which this method of lighting was first successfully introduced consisted of one combination baggage car and smoker and four ordinary passenger cars, the train running between Springfield and Northampton, Mass.

The equipment for the supply of these lamps consisted of a seven horse-power engine and a specially made 60-light dynamo, the total equipment in the baggage car occupying a floor space 6 by 4 feet, with a height of 6 feet. As to the cost of maintenance, which is one of the most essential questions involved, the renewals of battery up to Jan. 19 last, including repairs of machinery and depreciation upon the entire plant, amounted to less than 5 per cent. per annum.

The results secured in connection with this method of car lighting, led to the organization in July, 1888, of the Railway Electric Car Lighting and Signal Company, which acquired the right to the sole use throughout the United States of the Julien storage battery system, as applied to car lighting purposes, and also acquired control of the valuable patents owned by the Barrett Car Lighting Company. This consolidated company has recently placed its system on two vestibule trains on the Chicago, Milwaukee & St. Paul Railway, which, as there arranged, consists of a Brotherhood 4 × 3 engine, with an 80 volt 80 ampère dynamo, used in connection with 448 Julien accumulators distributed in convenient numbers in trays beneath the 14 cars of each train. This system is substantially the same as that used upon the Pullman vestibule trains running between New York and Chicago.

In the electric lighting installation found upon the Connecticut River Railroad, the Boston & Albany Railroad and upon the trains of the Chicago, Milwaukee & St. Paul and the Pullman vestibule trains, may be found fair examples of three methods of railroad electric lighting; in the first, as applied to an ordinary passenger train; in the second, as applied to a first-class train composed of drawing-room and ordinary coaches; in the third, as applied to a full palace car train of the most luxurious equipment, consisting of drawing-room cars, sleeping cars, dining-room car, etc.

It is probable that in the installation first named, namely, that upon the Connecticut River Railroad, the opportunity for ascertaining the relative cost of electric lighting as compared with other methods, under ordinary circumstances, has been more favorable than in either of the other instances. The cost of maintenance per annum, in this instance, based upon an original outlay of $2,500, amounts, as nearly as can be ascertained, to about $339 per annum, as follows: Interest on first expenditure at 6 per cent., $150; repairs to couplings, renewal of solution, etc., $2.50, per month, $30; depreciation of plant, as shown by renewals, $100; replacing lamps, $50; total, $330. This makes an expenditure for each lamp of about $4.64 per annum, or 1.49 cents, in round numbers, 1½ cents per lamp per day.

Supposing that the average amount per diem paid for services to one man employed in caring for 71 oil lamps on the same train, amounts to $1.50 (an under-estimate) we have for this item for 310 days $465. Add for cost of maintenance of oil lamps as above, oil chimneys, etc., per diem two cents each (the lowest estimate which I have ever heard made), $1.42 per day for 310 days, and we have an added sum of $440.20. Interest on original cost of oil lighting equipment for trains as above estimated, $500 at

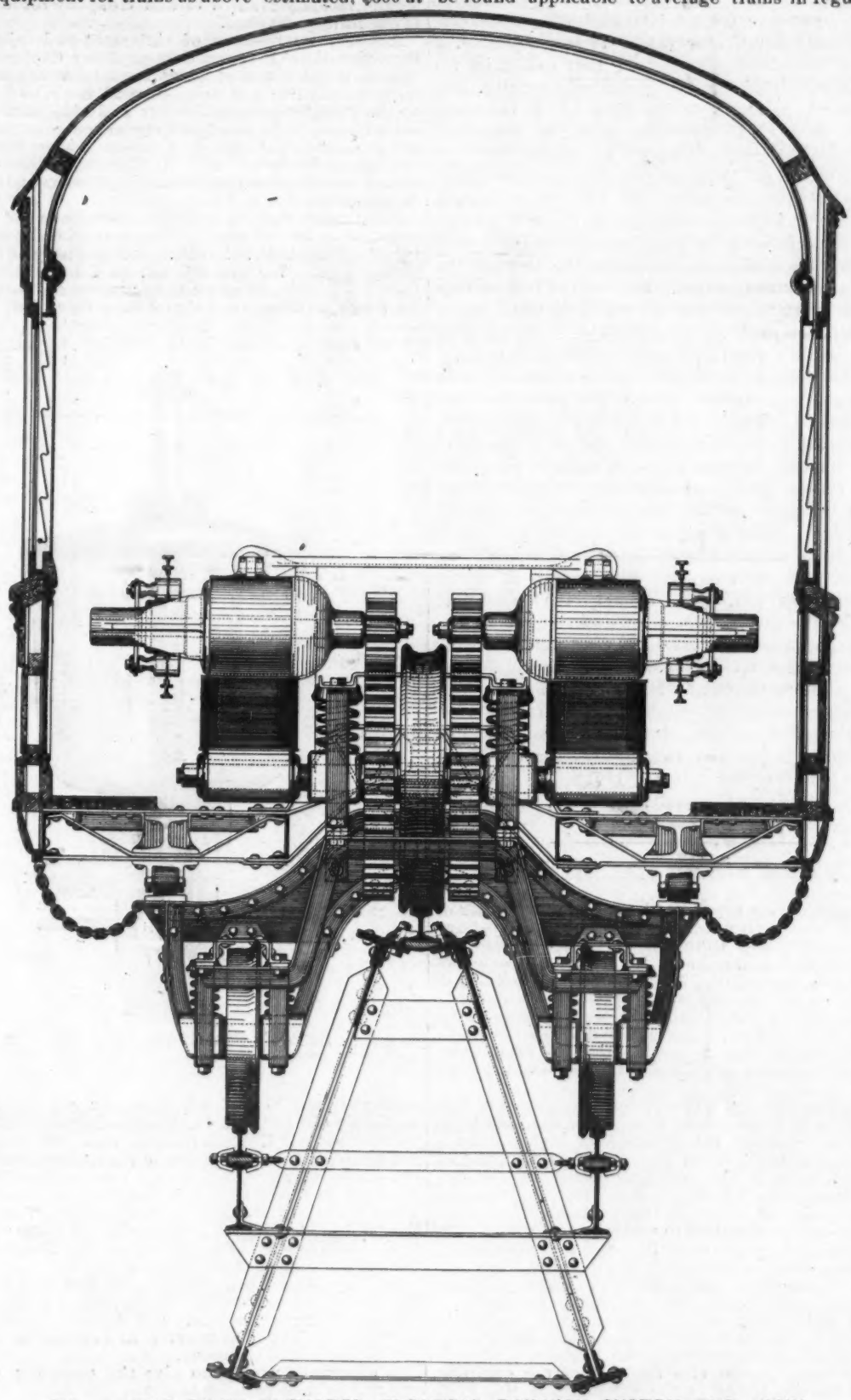


FIG. 2.—THE RILEY ELEVATED ELECTRIC RAILWAY SYSTEM—END VIEW.

6 per cent. per annum will amount to $30. Depreciation owing to wear of burners, etc., $1.50 per month for each car, will equal $90 per year. Adding these items, we find that the total cost of oil equipment per annum for 71 lamps will be $925.20.

As between the two systems the apparent difference in favor of electric lighting amounts to $595.20 per annum. It will be noted, however, that one item of expense in connection with the electric system is not here taken into account; namely, the cost of power taken from the locomotive boiler for the running of the combination machinery in the baggage car. As to what amount should be allowed in a comparative estimate as to the cost of the different systems of lighting on this account it will be difficult to say. Experience thus far upon trains where steam has been applied in this manner shows that the expense as represented by the additional power is almost inappreciable. It could not in any event represent a larger proportion of the whole cost of generating steam for the locomotive boiler, than that of 6 horse-power to 600 horse-power. As a matter of fact the actual cost would be very much less than in the ratio indicated. But supposing the steam used to represent an additional cost equal to its full amount, the value of this steam can be easily computed by a simple calculation based on the amount of coal required for every horse-power developed from the locomotive boiler. It is, I believe, generally understood, that the amount of coal required for this purpose is 7 lbs. This being true, to develop one horse-power per hour for 310 days will require 6½ tons of coal, which, at the rate of $4 per ton, would represent a total cost for the 310 days of $26. Supposing the daily service of the combination machinery in the baggage car on the Connecticut River road to be 6 hours, the total cost of 6 hours service, for a year of 310 days would be 6 times $26, namely $156. If we add this sum to the items of cost entering into a year's maintenance of the electric lighting system upon the Connecticut River road, as already presented, the total amount will be increased to $486, as compared with $925.20 for the oil lamp system, leaving a difference in favor of electric lighting of $439.20 per annum, the electric light costing $6.84 per lamp per year of 310 days, or 2 2 cents per lamp per day, and the oil lamp costing $13.03 per lamp per annum, or 4.2 cents per lamp per day. It may be urged that this presents an exceptionally favorable showing as to the cost of the electric system. Those who raise this objection are reminded that this estimate applies to ordinary passenger coaches running under the ordinary circumstances which will be found applicable to average trains in regular passenger service upon American railroads. It is in the lighting of trains of this character that the new system will be most widely used when it will have once proven its adaptability to such use, and it is therefore in this application of electric car lighting that the greater number of railroad officials, as well as the public generally, are most interested. I believe that the figures above presented do not overstate the economy with which the system of railroad electric lighting, as now being introduced by the Railway Car-Lighting & Signal Co., may be applied to the ordinary first-class coaches of trains in regular service upon American railroads. As a matter of fact the first application of this system has been chiefly upon special trains composed of parlor cars, where its application has involved expenditures proportionate with the lavish outlay made upon such trains in all other appointments. These trains require a prodigal supply of light, and not only this, but for a period in excess of that for which it is required under ordinary circumstances. The provisions for supply must, of necessity, be equal to the demand, and the cost of lighting upon these palace car trains under the circumstances becomes a matter difficult of computation. Moreover, upon such trains the service of employés is so adjusted to special needs, in accordance with set rules, as to make it difficult to carry into effect any arrangement by which employés already in service may successfully add the care of electric train lighting to their

present duties. As a result, in most instances special employés are provided, whose sole duties are confined to caring for the electric lights. Electric lighting upon such trains, for these obvious reasons, is proportionately very much more costly than upon ordinary trains, such as those upon the Connecticut River Railroad.

Brown's Self-Regulating Oil Cup.

It is an easily demonstable fact that bearings can be run with a much smaller quantity of oil than is ordinarily fed to them. If the engineer were to stand by a bearing and administer to it only that quantity of oil required to keep it in good condition, he would find that it would require only from one-fifth to one-tenth of that which he is in the habit of feeding it with normally. A slight change in the condition under which the bearing is at work, an increase of strain on a neighboring belt, or the working in of a particle of grit might call at once for an increased allowance temporarily, and as constant observation is impracticable, a normal feed, considerably exceeding that ordinarily required for perfect lubrication, is a practical necessity. The cup illustrated herewith is intended by its inventor, Gilman W. Brown, to overcome such a necessity, and to furnish automatically a supply of oil which will keep the bearing in proper running condition and no more. He has, so to speak, furnished the cup with a set of brains by which it accomplishes the same result as a man would who stood with his hand upon the bearing and regulated the feed of the cup to its varying temperature. Its essential feature consists in the thermostatic bar *A*, which is composed of strips of brass and steel. By a simple adjustment the valve is so set that at the normal temperature of the room the cup, when opened, will feed at the lowest rate compatible with easy running of the bearing. If for any cause the bearing commences to heat, the difference in expansion of the brass and steel of the thermostatic bar will cause it to move outward at the top, carrying the valve upon its upper end away from its seat and increasing the allowance of oil, which will be again reduced when the temperature decreases, and at all times maintained at the minimum. The feed may be stopped altogether when shutting down by simply turning one of the wings *B* down against the stop pin, and should the attendant forget to turn the cup on when starting no harm can result, as it would commence to feed automatically after the bearing had warmed up a few degrees. The design of the cup as a cup is excellent. Being unincumbered with brass trimmings outside, it permits an unobstructed view of the oil from all directions. It can be readily filled and wiped out on the inside and thoroughly cleaned in every respect, without removal from the bearing. The Crosby Steam Gage and Valve Company, of Boston, are the general agents.

Meeting of the Board of Electrical Control.

Mayor Grant is very much on the alert in the matter of the subways, and having reason, as he thought, to believe that the United States Illuminating Company was not dealing "fair and square" with the Board, he called a special meeting on the 5th. The occasion proved a culminating point of the steadfast opposition which has been so long shown by the United States Company to the injunctions of the Board. The matter resolved itself to a considerable extent into a wordy duel between Commissioner Gibbens and Mr. Lynch, the president of the company.

A formal arraignment was read by Commissioner Gibbens, in which it was stated that when the Board had granted to the company the privilege of laying down a test cable in the subways, the Board understood that all the poles and wires of the company would be removed from the streets within forty-five days' time, and also that within that time the company would have provided an efficient underground system to replace the present overhead system, which should be entirely abandoned. Nevertheless, the company had through the Consolidated Telegraph and Electric Subway Company, made application in a manner which of itself was not calculated to increase the confidence of the board, to Commissioner Smith of the Department of Public Works, for permits to make fifty-seven subsidiary connections. It was also stated that the company had only a few arc lights in the district, and that their business could be done with ten, or at the outside twenty, subsidiary connections; and that the course which the company was adopting was simply leading up to an evasion of the real point at issue, and would cause the test to be practically of no avail.

The charges concluded as follows: "The consideration of this information leads me to declare before your Honor that I believe the United States Illuminating Company to be guilty of a gross breach of faith in accepting the opportunity to make a test of the electrical subways for the purpose of its business, or if not in accepting the opportunity, then much more so in taking advantage of it. For this reason I repectfully petition your Honor to request the Commissioner of Public Works to revoke the permits granted by him for the opening of the streets, for the purpose of making subsidiary connections, and that your Honor will reconsider your action of clemency in giving the United States Illuminating Company forty-five days in which to remove its poles and wires from the surface of the streets, and will sign the accompanying order upon the Commissioner of Public Works, directing him to remove forthwith all the poles and wires of the United States Illuminating Company upon the streets and avenues where subways have been provided sufficient, in the opinion of the Board of Electrical Control, for the business purposes of this company, and where ninety days notice to that effect has been given to the company and has expired."

After the charges had been recited the Mayor asked Mr. Lynch what he had to say against them.

Mr. LYNCH said that while the object of the test was to enable his company to see whether its arc light circuits would work in the subways, the Board had, in a particular district, driven them out of business, and they had now no arc light customers; the company had done the best it could, and had tried to keep faith with the Board.

This was evidently too much for Commissioner Gibbens, who promptly interjected: "It is not true; you have wilfully deceived it."

Mr. LYNCH: "That is false, and you know it."

MAYOR GRANT (pounding the table): I agree with the Commissioner. From your own statement you have no further use for the subway, and I shall request the Commissioner of Public Works to revoke the permit for the connections. I have tried to act fair and square with your company, and now it seems to me you have been trifling with us. Now, once for all, I want it distinctly understood that your wires and the wires of every other company must go underground. Mr. Smith (to the Commissioner of Public Works), you will please see that the permit recently granted to this company for a test cable of one mile be revoked.

A lively interchange of statement and rejoinder was then carried on between Commissioner Gibbens and Mr. Lynch, in the course of which the former remarked that the company had not acted in good faith, as it had torn up the pavements along the line and was putting in an entirely new plant to make sixty new connections for the test of sixty new lamps.

"That is not true," said Mr. Lynch, excitedly, "and I should like to know what authority you have for making the statement."

"The authority is my own conscience and my judgment," said Mr. Gibbens. "That's a damned poor foundation," shouted Mr. Lynch. "Everybody knows you pretty well. We are willing, as I have said, to make these tests, and take down the poles when we find that the test is satisfactory, but you have now shut us out of

BROWN'S SELF-REGULATING OIL CUP.

Sixth avenue. Now, I will show you we are willing to make any fair test that the Board asks us to make."

Commissioner Gibbens insisted that the company was not honest in this declaration of its purpose, and he urged the mayor to allow no further time. He said that the company had been twice notified that they must get their wires underground. They had had a further extension of time to the 22d of April, and he did not think that it was in accordance with the interests of the Board that any further leniency should be shown.

Mr. LYNCH then urged the Mayor, as a new member of the Board, not to have his views perverted by the influence of the other members, and further promises were given by Mr. Lynch as to early and legitimate action by the United States Company.

It was finally decided to give the company one more chance, on their promise to put up ten lamps on Broadway, between Seventeenth and Thirty-fourth streets, and make a test of the subways before May 2.

The question of the removal of the police wires was then taken up, and President French, of the Police Board, assured the Mayor that he was very anxious to have the police telegraph wires buried, and would consult the Corporation Counsel as to the transfer of an appropriation for the purpose of carrying out that object.

The Manhattan Electric Light Company, which had put up fifteen new poles on East Fourteenth street, after having received permission to erect only twelve, promised to remove immediately the three additional poles.

The Board met again on the 7th, when the Western Union Telegraph Company put in a report showing the number of poles and wires it has removed since January 1, 1888, and described the different operations that are now being carried on by the company in placing cables on the elevated railroad structure, and making necessary connections.

The Fire Department asked for information as to what new subway routes would be opened this summer, as the department has in view the extension of its wires.

The Engineer of the Board was instructed to report at the next meeting as to the work laid out last year which was not completed.

A letter was read from the United States Illuminating Company which stated that "by the kind permission of the Mayor" the company will make a test of ten arc lights in Broadway, supplied from cables laid in the conduits, and that these wires will be placed on disused gas-lamp posts. Permission was given.

The Board adjourned to the 12th inst.

The Massachusetts Legislature and Electric Railway Wires in Boston.

The street railway committee of the Massachusetts legislature has been carrying on a hearing relative to the measure granting permission to the West End Railway Company, of Boston, and others, to run overhead electric railway conductors through the streets of Boston and other Massachusetts cities. A large number of persons interested in street railways, together with a number of prominent electricians and others interested in the subject, were present at the meetings and took part in the discussion, which was confined principally to the question of danger to life and property.

Hon. F. O. Prince appeared for the remonstrants, and said that if the overhead system was a necessity they must submit, but he believed it was not a necessity, inasmuch as there were other systems, such as the storage battery and underground conduit, which are entirely practical. He characterized the overhead wires as unsightly and dangerous to life and property, and considered it unwise, in the present experimental state of electrical knowledge, to enact a general law allowing companies to use electricity in this objectionable and dangerous manner at the option of boards of aldermen and selectmen.

Mr. William Bracken, President of the Julien Electric Company of New York, said that the time had not come when the practicability of overhead lines was demonstrated, and that they were unsightly and an element of danger. Mr. Bracken challenged the West End Railway Company, or any other company, to tell at the present time what it cost to run a car by electricity. They were, however, going to gridiron the city with wires before they knew whether the system was practical or not, and without any knowledge of what is being done toward perfecting the operations of electric street railways, without the objections due to overhead conductors. Mr. Bracken then spoke of the general demand for burying the present overhead wires in the principal cities of Europe and America, wires that are absolutely safe in comparison with those required for the operation of electric railways, and which do not offer nearly so great an obstruction, despite their number, as would the overhead electric railway wires and the supports required for them. Mr. Bracken further declared that the conduit system or the secondary battery must finally be adopted. With regard to the alleged failure of the conduit system in Boston, Mr. Bracken said that the conduit was doing a thousand times better than the overhead system was doing a year ago, and that forthcoming improvements would place it far ahead of the overhead system for city use. He also went on to speak at length of the advantages of the storage battery system, and stated that his own company had four cars in regular service on the Fourth avenue and Madison avenue line in New York, where they are giving excellent satisfaction, and that he was prepared to place a car upon the West End Company's line for the purpose of demonstrating its superiority over the overhead system.

An affidavit was then read from Mr. Elias E. Ries, of the Ries Electric Railway System, of Baltimore, which was listened to with more than ordinary interest, setting forth some of the principal objections against the use of overhead conductors for electric railways in cities, and stating that their introduction would tend to retard the burial of the present overhead wires. Mr. Ries further stated that it was too early to decide that the overhead system is the only practical form for cities, that it was not objectionable for suburban roads, but that the conduit system or the secondary battery would eventually be adopted in crowded cities. He also said that many prominent inventors and electricians are at work on systems of electrical traction that are specially applicable to city traffic and not open to the objections incident to the use of overhead conductors.

An affidavit was also read from Dr. P. H. Vander Weyde, in which particular stress was laid upon the danger of the bare overhead wires being struck by lightning, and the committee subsequently listened to the remonstrance of the North American Insurance Company, who stated that the overhead wires, owing to their unprotected nature, are an ever probable cause of fire by reason of telephone wires falling upon them, and that the wires are furthermore a hindrance to the fire department as they prevent the putting up of ladders, and the wires used, as on the Cambridge electric railway, are so thick that they cannot be cut by the shears used by the fire department.

Mr. Ries, who was present at the meeting, was asked in reference to the danger attending the employment of overhead electric railway wires. He stated that numerous cases have occurred and are likely to again occur, where persons have received severe shocks, and in some instances, sustained permanent injuries from currents such as used on the Boston electric railways, and that under certain conditions it was possible for persons to receive a fatal shock from an electric railway circuit carrying current at an electromotive force of 500 volts, which is the pressure said to be used on these lines. The danger from this cause is increased, Mr. Ries said, when the track rails or ground are used as the return conductor, as is the case in nearly all of the overhead conductor electric railways so far put in operation. When a large number of cars are to be operated it will be necessary either to increase the potential of the current or to run supplementary main and feeding conductors of large carrying capacity, both of which are objectionable, and especially so if these conductors are carried overhead.

Prof. Elihu Thomson, of the Thomson-Houston Electric Company, was called as an expert in behalf of the West End Railway Company. He maintained that the voltage used on the Boston railways (500 volts) was perfectly harmless, and stated that he did not know of a fatal shock ever having been received on any of the electric railway lines in this country. He said that in New York the Western Union Telegraph Company have used a pressure of 400 volts on their telegraph lines for the past fifteen years, and that no harm has come from it. To prevent accidental contact with telephone and other conductors his company proposed to run guard wires above the electric railway conductors, and to obviate the use of too large an overhead conductor on lines having a heavy traffic, he would increase the number of power stations along the line of railway, or run underground feeding conductors of sufficient size to

carry the current to the overhead wires. With regard to the danger from fire, he stated that instead of being an objection the overhead wires would prove an advantage, since the current furnished by them might be used to operate electrical fire engines to put out fires. On cross-examination by Mr. Ries, Professor Thomson admitted that the railway current might burn out and set fire to an unprotected telephone instrument in case of a "cross" between the telephone line and the railway wire, and that it was possible for a person to receive a very severe, though not fatal, shock from a 500-volt current. Professor Thomson further admitted that a practicable underground conduit system was less objectionable than the overhead system for city use, and stated that he would be one of the first to welcome such a conduit, but that he did not then know of any conduit that would answer the requirements.

A somewhat lively discussion took place between Professor Thomson and Mr. Bracken during Wednesday's session, in which the latter charged Professor Thomson with trying to influence the minds of the committee by making certain statements relative to the alleged safety of very high tension currents, which the Professor said he had taken without injury, and in withholding information whereby the degree of danger might be determined. It was brought out that an electromotive force of 10,000 volts could be taken with safety from an induction coil in which the current generated was so small that it amounted to but a very small fraction of one ampère, but that in the operation of electric railways the current may reach several hundred ampères, and that the amount of current that can be received by a person is only limited by his resistance as compared with that of the motors on the line, which resistance differs in different persons.

Mr. C. J. H. Woodbury, Captain Griffin, and others also spoke in behalf of the Thomson-Houston and West End companies. Several witnesses were produced who testified to receiving more or less severe shocks from the overhead conductors, the potential and current strength of which, however, they were unable to state, and they showed by their presence that they were still "alive and kicking." The committee adjourned before the testimony was concluded, and will listen to further arguments upon a date to be appointed by them. Several interesting developments may be looked for, as the bill, if passed, will be likely to re-open the entire overhead wire question.

On Certain Phenomena Connected with Imperfect Earth in Telegraph Circuits.*

BY A. E. KENNELLY.

These phenomena are presented by the Atlantic cables of the Direct United States Cable Company, with whose permission the facts are laid before the Institution.

The two cables of this company terminating in Nova Scotia run to Ireland and to Rye Beach respectively. Their landing place was originally Torbay, N. S., but they were removed thence to Halifax some eighteen months since.

The accompanying map supplies the outlines and main features of Halifax Harbor. The Irish cable was first brought into the cable house, situated 40 feet above high-water mark, upon the beach opposite George Island, on the 23d October, 1887, and it was put in communication with the town office by means of a line cable and a return earth cable, side by side, in an iron pipe. Each cable was 0.7 knot long, had a resistance of 8.3 ohms, a capacity of 0.25 ohm, and a high insulation. The line cable united with the Irish shore end through lightning guards, while the earth cable made good soldered connection with the shore end sheathing.

Some vibration of the mirror spot, due to electrical disturbance, was noticed on first joining up the circuit at the office through instrument and condensers, but this was at the time attributed to faults which then existed in the cable. Beyond this continual vibration, no noteworthy feature occurred until six days later (29th October), when the Rye Beach cable was landed at the same cable-house, and joined up with the office by a precisely similar pair of cables running through iron piping in the same trench with the other above mentioned. This cable is worked on a double-current Morse system without condensers, and it was immediately noticed that sending to Rye Beach with 12 volts of battery power visibly disturbed the mirror spot on the Irish circuit, although each cable made earth separately through its own sheathing via the insulated return cables to the beach. Receiving from Rye Beach did not disturb the mirror, nor did the operation of the Irish cable in its turn affect the less delicate apparatus of the Morse circuit.

The only remedy that could be, or has since been, practically available without adding to the retardation of the circuits, was the reduction of the Morse battery power on one hand, and the sensitiveness of the Irish mirror on the other, as far as the operation of the circuits would conveniently permit.

After the removal of the faults in the Irish cable the vibrations of the mirror still continued, and it was noticed that not only these, but periods of disturbance coincident with local meteorological changes, affected the signals more than had been on record with the same circuit when worked previously from Torbay. On this was superposed the interference caused by transmission on the Rye Beach circuit, and the combined disturbance at times made the mirror signals difficult to read.

The Rye Beach shore end was at first laid very near to the Irish cable, and actually over it at one or two points. The cables were, however, subsequently separated, although they necessarily lie at different points in close proximity. This separation of the cables was found to have sensibly lessened their interference.

The operation of the cables from the cable-house instead of from the office was found to produce no change in the nature or degree of disturbance, while experiment failed to produce any visible interference between the trenched cable circuits from office to beach, even on the most delicate instruments.

A third cable was then laid from the cable-house across the harbor, and out through the eastern passage in the direction shown on the diagram. It had a total length of 5.8 knots, sheathed up to within half a mile of the sea end. This unsheathed half mile of core terminated in a copper earth-plate one yard square, nearly on a line between Thrumcap Rock and Hartland Point. This well insulated line offered every prospect of securing a good and independent earth by its large terminal plate. When, however, it was joined up at the cable house with the Irish circuit, in the place of the Irish shore end sheathing, the interference from the Rye Beach transmission remained as marked as ever.

To determine the nature of this obstinate interference, a series of experiments was made at the cable-house as follows:

All existing connections were for the time dismantled, and only the two cables, the two earth-wires soldered to their respective sheathings, and the core of the third cable, or six-mile earth, were brought up to the testing table.

The resistances between these three earth-wire terminals was measured as follows by bridge:

Between Irish sheathing and Rye Beach sheathing	0.16 ohm	all steady.
Between Irish sheathing and six-mile earth	65.7 ohms	
" Rye Beach " " "	65.7 ohms	

From which the resistance of each sheathing earth connection would, of course, be 0.8 ohm, and of the six-mile earth 65.6 ohms.

The only apparatus then retained for investigation was a Daniell battery of fourteen gravity cells—used with, and sometimes also without, a pole-changer—for exciting disturbance, and a sensitive speaking mirror—used with, and also without, condensers of 40 microfarads capacity—to render any interference visible.

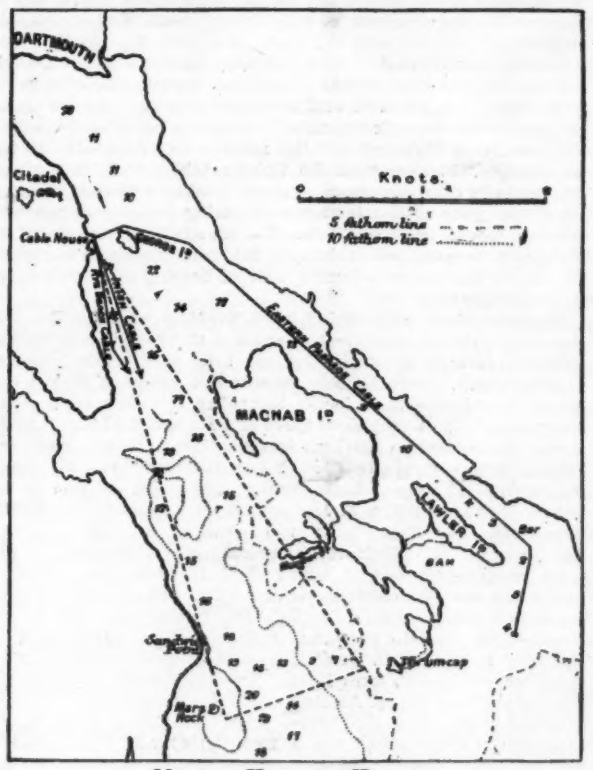
Experiment 1.—Sending reversals from seven cells into the Rye Beach cable produced vibrations of the spot on the mirror instrument in circuit with the Irish cable, its sheathing, and 40 microfarads.

Experiment 2.—Similarly, sending reversals into the Irish cable, using its sheathing, produced vibrations on the mirror in circuit with the Rye Beach cable condenser and sheathing.

Experiment 3.—Sending reversals into the Rye Beach cable produced vibrations on the mirror in circuit with the Irish cable condenser and six-mile earth.

Experiment 4.—Sending reversals into the Rye Beach cable, using six-mile earth, produced vibrations on the mirror in circuit with the Irish cable condenser and its own sheathing.

Experiment 5.—Sending reversals into the Irish cable,



MAP OF HALIFAX HARBOR.

using the six-mile earth, produced vibrations on the mirror in circuit with the Rye Beach cable condenser and its own sheathing.

Experiment 6.—Sending reversals into the Irish cable, using its own sheathing, produced vibrations on the mirror in circuit with the Rye Beach cable condenser and six-mile earth.

Experiment 7.—Sending reversals on the circuit formed by the six-mile earth, battery and Rye Beach sheathing, the disturbance on the mirror in circuit with the Irish cable condenser and sheathing was more decided than in any of the preceding experiments.

Experiment 8.—Similarly, sending reversals on the circuit formed by the six-mile earth, battery and Irish cable sheathing, the disturbance on the mirror in circuit with the Rye Beach cable condenser and sheathing was equally great.

Experiment 9.—The last two experiments were repeated with the condenser removed and the mirror in direct circuit between cable and sheathing. The continual vibration of the spot made observation difficult; but during periods of comparative quiescence it was soon determined that the disturbance produced by depressing one of the keys was not of a momentary nature only, but consisted of a small deflection, permanent during the whole period of key application, and of direction depending upon the key selected. It was also ascertained that this deflection was not due to any local electro-magnetic action by

Experiment 10.—On sending reversals between the two cable sheathings in circuit with the battery, no disturbance could be detected on the mirror in circuit with one of the cables and the six-mile earth.

This small steady deflection produced by holding down the key in either of the two cases tried in Experiment 9 was more plainly visible when the mirror was in circuit with the Rye Beach cable, which, besides its shorter length, had no condenser in circuit at the distant station. To obtain some quantitative information regarding the strength of current represented, the fourteen cells were connected in series and more careful observations made.

Experiment 11.—Closing the circuit formed by the fourteen cells, the six-mile earth, and Irish sheathing, measurements were made of the steady deflection so produced on the mirror joined up with the Rye Beach cable and sheathing.

The deflection obtained was subsequently found to approximately represent the two-hundred-thousandth part of an ampère—*i. e.*, five micro-ampères—and its direction was observed to be that indicating a current entering the Rye Beach cable from that pole of the battery which was connected to the Irish sheathing, reversing when the battery was reversed.

Experiment 12.—The Irish sheathing was replaced in the battery circuit by the water-pipe earth connection at the office through the trenched cable. On depressing the key the mirror showed the same permanent degree of disturbance as before in each cable circuit.

Experiment 13.—This experiment was a repetition of No. 8, with the condenser removed. It was subsequently observed in this case that the disturbance was not permanent during the depression of the battery key, but consisted of a small vibration of the spot at the opening and the closing of the battery circuit.

Experiment 14.—This was carried out at the office, situated in the principal street of the town, and nearly opposite to the Western Union Telegraph Office, fifty yards distant. All the Western Union wires overhead, and the earth connections made for them are the gas and water mains, which, with the telephone lines, form the only metallic connection between the two buildings. With the courteous assistance of the Western Union officials it was arranged that at a given word by telephone several of their circuits should suddenly be operated, and again, all stopped.

When this was done the effect was distinctly visible upon a mirror in circuit with each cable, the disturbance being greater on the Rye Beach line, the earth connections being the cable sheathings through the insulated cables in the trench. Only four known causes could under any conditions produce interference between the two cable circuits, these being, of course, electrostatic induction, electro-magnetic induction, leakage, or bad earth connection in common; and, in the absence of evidence, any one or more might produce it, although no reason could be demanded for the operation of any, since cables lie in other parts of the world for greater distances at equal proximity without the least visible interference.

Experiment No. 10, together with the preliminary trials with the trenched cables, showed that the causes were not to be traced locally to these or to the apparatus; and the high insulation of the cables and circuits, together with the fact that the tests were carried out at the cable house, precluded all possibility of leakage being concerned, so that the operating causes were thus limited to the two forms of induction and bad earth.

The first six experiments did not directly point in favor of any particular cause, but Nos. 7 and 8 rendered the possibility of electro-magnetic disturbance untenable, since the exciting circuit, except in the cable sheathing itself, took a course, as seen on the map, almost at right angles to the two main cables. They further showed that the interference was such as a deficient earth connection would produce. Experiment No. 9 confirmed this view, since no form of induction could set up the steady deflections observed; and leakage being out of the question, bad earth was the only cause that could produce them. It was further necessary to suppose that not only one but both cable sheathings failed to secure good earth, and that the resistance in their respective earth connections was common to both.

Experiment 11 corroborated this position, and No. 12 did more, for it extended the limits of this bad earth region over the whole water-pipe area of Halifax, as it would have been impossible to obtain interference under those conditions unless the cable sheathings and the town water pipes formed a common conducting system throughout whose limits imperfect earth connection existed. Finally, the evidence of Experiment 14 followed the same direction, the exciting circuit being in this case the Western Union land lines.

The imputation of bad earth to the gas and water-pipe area of a town, and that town a seaport, is sufficiently remarkable, but the presumption of a general earth imperfection in a system of extended water and gas mains, together with the sheathings of three cables running directly into an arm of the sea, may at first sight appear an outrage upon credulity. Due consideration of the experimental evidence renders the conclusion, however, inevitable, and this is tantamount to the assertion that the whole of this system—that is to say, all the land covered by the town, as well as that forming the harbor basin—is composed of substance more or less insulated or insulating.

One of the most interesting features in the geology of Nova Scotia is that the Atlantic seaboard presents an uninterrupted line of Lower Cambrian formation. The relation of this fact to our immediate subject is patent when we remember that these rocks—early in order of geological structure, and said to be almost destitute of organic remains—are here almost entirely composed of argillites, quartzites and micaceous schists—slates and grits—substances experimentally known to be non-conductors; and according to the published papers of Professor Honeyman, who has studied the geology of Nova Scotia for many years, no other formations mingle with the Lower Cambrian in the structure of the Halifax basin except the still lower archæan granites, all of which are presumably non-conductors. In fact, the renowned natural advantages of Halifax harbor are due to the unrelieved presence of these abrupt slaty cliffs that immediately underlie the soil for miles inland.

It is said that in the Lake Superior region of the United States great difficulty has occasionally been found in obtaining efficient earth, even when no local cause for the deficiency has been apparent. I am indebted to Prof. Moses G. Farmer for the facts of a case which came under his notice, where an earth connection, apparently good and well situated, was found useless, and measurement showed that its resistance to earth was 12,000 ohms. I also owe to him the information that interference due to imperfect earth was found in 1869 at St. Pierre Miquelon, the Morse signals on the St. Pierre Placentia circuit affecting the Atlantic cable to Brest, and that special measures had to be taken to effect better earth connection.

Generalizing afrom these facts, it would seem that there may be difficulty in obtaining good earth at cable stations opened on a shore of primary or metamorphic rock, and that permanent interference beyond remedy by earth connection is possible between cables landed in a basin of such formation; so that if this statement receive confimation at the hands of the members of this institution it will be evident that a due regard will be given to geological conditions by electrical engineers among the many incidental considerations that determine their selection of a cable's landing place.

* Abstract of a paper read before the London Institution of Electrical Engineers, Feb. 14, 1889.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, March 11, 1889.

Sibley & Chapin.—Mr. C. C. Sibley, who resigned some time since from the Splitdorf Insulated Wire Company, is now interested in the above firm, at 602-604 West 22d street. They are manufacturers of electrical apparatus and special machinery, and pay attention also to gear cutting, screw cutting, etc. They are an active young concern to whom business may be safely and profitably entrusted.

The India Rubber and Gutta Percha Insulating Company, of 159 Front street, this city, has reprinted and issued in neat pamphlet form, from the *India Rubber and Gutta Percha Electrical Trades Journal*, an interesting article on india rubber and gutta percha and other insulating materials compared. This article is an excellent discussion of the subject, and its perusal will well repay those who are interested in having first class conductors for current, whether of high or of low tension.

The Fiske & Mott Insulator, which was illustrated and described in your columns two or three years ago, is now being made and sold by Mr. W. Brookfield, 45 Cliff street, this city. It is a high resistance insulator, useful for all classes of service. A minimum contact surface is offered to the wire through the simple, yet effective device of placing in the groove six ribs on which the wire rests, so that without any loss of sustaining power the total contact is only about half an inch. Evidently there is a vastly higher insulation resistance on the line wire.

Telephone Legislation.—Now that an attack is being made by our legislature upon the telephone interests in this State, it will be well for them to take a lesson by what has occurred elsewhere. In Indiana, which was the scene some time ago of one of the most desperate attacks on the telephone interest, there appears to be quite a revulsion of popular feeling, as might be expected, and I understand that the law for the repeal of the anti-telephone legislation of two or three years ago has reached the Governor, and will receive his signature, if, indeed, it has not already done so.

The Sawyer-Man Electric Company issue a very handsome and tasteful price-list of their appliances for incandescent electric lighting. It has a frontispiece of the big factory on West 23d street, and contains about 72 pages of illustrated matter relative to their lamps, sockets, water and weatherproof attachments, switches, attachment blocks, cut-outs, fuse links, holders, shades, globes, reflectors, insulated joints, canopies, voltmeters, ammeters, balance indicators, electric cigar lighters, stage regulators, magneto bells, and a number of other appliances. These are all furnished at close prices and are built for long service and the satisfaction of customers. It may be mentioned that the lamps shown in the catalogue are made to fit Sawyer-Man, Westinghouse, Thomson-Houston, United States, Brush-Swan, Edison, Queen City and Hawkeye sockets.

The Work of Architects.—In company with Mr. Adler, of Einbigler & Adler, Seventh avenue near 34th street, I happened to meet at lunch one day last week Mr. J. B. McElfatrick, the architect, of East 14th street. The latter concern have furnished plants for many of the principal theatres in this city, and naturally are very much interested in the subject of electric lighting. In fact, it would be hard nowadays to find a prominent architect who has not to give serious attention to this subject. The firm in question planned the new Manhattan Theatre at Harlem, which is to be fully lighted by electricity, and they have two new large theatres at Philadelphia in hand. Mr. Adler's firm are fitting out the Union Square Theatre with their special work in brass and antique iron railing, and they have planned some very handsome fronts for the gallery, beautiful both in design and execution. The Union Square Theatre is being wired for over 1,000 lights by Augustus Noll & Co., for the Manhattan Electric Light Company, which will furnish the current.

The West Side Electric Light and Power Company, under the superintendence of Mr. W. H. Cole, has been doing exceedingly well. On Feb. 23 Mr. Cole completed the installation of a Manning boiler, a Ball engine of 100 h. p., and a Slattery alternating machine of over a thousand light capacity. This dynamo has been running at 400 revolutions, and has supplied its 1,000 lights with the utmost ease. Mr. Cole is now lighting Father Brophy's church at Fifty-first street and Tenth avenue with 400 lamps, and it is said to be the best lit church in this city, if not in the country. The church of the Paulist Fathers at Fifty-ninth street and Ninth avenue has been wired for 500 lights, but has not yet been put into circuit, although it will be very shortly. Mr. Cole is delighted with the work of his steam and electric plant. He tells me that a supply of coal, weighing 15 tons, was put in Feb. 23. He has been running 21 hours out of 24 hours every day since, often carrying 1,000 lights, and still has some of the coal left. Mr. Cole thinks that such results will compare very favorably with those yielded by oil, of which so much has been said of late. He is now proceeding to install another dynamo, engine and boiler plant, and before he gets through proposes to have 50,000 lights running from his station. He uses the best Grimshaw wire throughout, finding it yields him the utmost satisfaction.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, March 11, 1889.

Personal.—Messrs. Arthur D. Newton and M. E. Baird, of the Eddy Electric Manufacturing Company, Windsor, Conn., were in Boston last Thursday, and favored this office with a visit.

Royal Five-Ampere Switch.—Messrs. Pettingell, Andrews & Co., Boston, Mass., report having a remarkable "drive" on their "Royal" five-ampère switch; and, though large quantities are being manufactured daily, the product is scarcely sufficient to supply the demand.

New Station.—The Woodburn (Mass.) Electric Light Company's new station is nearly ready for business. The equipment for the dynamo-room and power department, respectively, is about all in position. Among the new machinery just received is a handsome 100 h. p. steam engine, compound condensing, of the McIntosh, Seymour & Co. make.

John Post, Jr., & Co. have been very busy during the past two months filling contracts on electric light station and steam plant equipments. Among their customers are the Plymouth, Mass., Electric Light Company, Eastport, Me., Electric Light Company and the Plympton Manufacturing Company, Hartford, Conn. The well-known and popular Ide engine was installed in the steam plants of the companies named.

New Offices.—Messrs. Paine & Francis, of Boston, the New England agents of the Edison United Manufacturing Company, have become nicely settled in their spacious new offices at No. 38 Pearl street, corner of Franklin street, Boston. The New England Wiring and Construction Company, Mr. Walter J. Paine, manager, has taken a suite of handsome offices on the same floor as (and adjoining) those of the Edison people.

New England Telephone.—It is reported that Messrs. Lee, Higginson & Co. and Jackson & Curtis sent out to the stockholders of the New England Telephone Company to-night a circular offering at par $500,000 6 per cent. ten-year bonds of the telephone company, interest payable April 1 and Oct. 1, and the bonds to be dated April 1, 1889. The bonds cannot be drawn, but after April 1, 1894, the company will buy each year for cancellation $50,000 at not exceeding 102 and interest. Any bonds not taken by shareholders will be taken by the banking companies.

A New Electrical Book.—An interesting and instructive book, entitled "Modern Electricity," has just been published by De Wolfe, Fiske & Co., Boston. It is from the pen of Mr. Thomas Kirwan, a gentleman of considerable prominence in the literary field and well known among the electrical fraternity. The object of the writer of this book is in presenting in a plain and comprehensive manner matters pertaining to the theory and practice of electricity, so that the reader will understand them without prior knowledge of electrical science.

President Howard Stockton, of the American Bell Telephone Company, will resign, to accept the treasurership of the Merrimac Manufacturing Company, to which he has been elected. Mr. Stockton left the Cocheco and Salmon Falls Mill Companies to fill his present position, retaining, however, his connection with the Essex Company. He returns to mill life from choice, and with the regrets of the Bell people. The date of separation and the name of a successor have not been determined yet. The directors of the telephone company hold a regular meeting next Wednesday, when I believe Mr. W. R. Driver will be elected president.

Boston Electric Club.—At the monthly meeting of the club, Monday evening, March 4, considerable important business was transacted. Several amendments to the Constitution and By-Laws were adopted. It was voted to have liquors and other refreshments served in the small ante-room, just off the billiard parlor. The new club rooms are so attractive, and the locality so convenient and otherwise desirable that the average nightly attendance has never been so large since the organization of the club as it has been during the past thirty days. It is decidedly encouraging to note also the increased attendance at the regular meetings of last, as well as the present month, not only of the club, but also of the various committees.

Rotary Lightning.—At the last meeting of the Boston Electric Club on March 6, which was a most successful affair, Dr. M. G. Parker read a paper on "Peculiar Rotary Motions Found in Lightning and Other Electric Currents." After the paper had been read the room was darkened and the subject was illustrated by the stereopticon. Flashes from the Holtz machine were first given, showing the currents separating and joining again at irregular intervals. Then ribbon, beaded, meandering and stream lightning was shown with great clearness. The illustrations were closed by a Western tornado scene, showing the destroying wind in motion. Dr. Parker was given a hearty vote of thanks, after which the meeting adjourned.

Malden (Mass.) Electric Light Station.—During the past six months the increase in the number of arc and incandescent lights in operation by this station has been remarkable—probably unprecedented. Within a few months the people of Malden and neighboring towns have begun to realize the advantages of the electric light. In a very short space of time the lighting capacity of the Malden station has been increased from 45 arc lights and 200 incandescent lights, to 200 arc lights, 1,000 incandescent alternating lights and 400 direct incandescent lights. In addition to the city of Malden, with its 81 arcs and 286 incandescents, the electric lights are furnished from the station to the neighboring towns of Medford, Everett and Melrose. The town of Medford has 23 arcs and 81 incandescents. Everett has 15 arcs and 200 incandescents, and Melrose has 27 arcs and 40 incandescent lights. All of the lights mentioned are used on the streets or for domestic purposes. Malden and the towns named are also supplied from the same station for commercial use, with 22 arc lights and 800 incandescent lights. The equipment comprises the following: Four 80 h. p. Armington & Sims engines, three 125 h. p. Whittier boilers (with the Jarvis patent setting), a Worthington condenser, a Blake pump, and a Korting injector. The dynamos are all from the Thomson-Houston Electric Company's factory, and consist of four 50-arc-light machines, two 500-light incandescent (alternating) machines, and one 400-light direct incandescent machine. All of the aerial wiring (about 150 miles) is composed of Simplex wire, and for the inside wiring work (domestic and commercial) only Okonite wire is used. The inside wiring is all concealed, and shows the handiwork of experienced and skillful workmen. The officers of the Malden Electric Light Company are John S. Bartlett, president; H. A. Royce, treasurer and general manager, and A. E. Bliss, superintendent. Mr. F. W. Crocker is the electrician and engineer.

Interesting Stock Quotations.—In the financial column of the Boston *Herald* March 5, the following appeared: "Thomson Electric Welding stock sold at 350 to-day. This company is capitalized for $500,000, 5000 shares of the par value of $100, and all but 500 shares are outstanding. The company has shops at Lynn and is running them day and night to fill orders for machinery to apply the process. Stock of the Edison Phonograph Toy Manufacturing Company sold at 15 to-day for 500 shares. Messrs. Clark, Ward & Co. had 10,000 shares of the 60,000 shares of $10 (par) stock to offer, and it has all been taken at par, less commission in some cases. It sold at 10 yesterday and is up 50 per cent. to-day. The motive of this writing," says the Boston *Herald*, "is not to boom it, but to record the history of the day, of which dealings in speculative ventures now constitute a prominent part. This is a Maine company whose officers are: W. W. Jacques, president; Lowell C. Briggs, treasurer; Herman Frost, of New York, Lowell C. Briggs and W. W. Jacques, of Boston, directors. The office of the company is in Boston. The company holds the exclusive right from Thomas A. Edison for the use of the phonograph in dolls and toy figures for the United States and all foreign countries. It also owns, exclusively, letters patent for phonograph dolls in the United States, Great Britain, France, Belgium, Italy, Switzerland, Germany, Austria, Russia, Hungary, Canada, Denmark, and the Australian colonies, Victoria and New South Wales. The prospectus estimates that 700,000 dolls can be sold at $5 each, and claims that 500,000 have already been sold, 300,000 going to France alone. The dolls for the American market are being manufactured in Germany, and the Edison Phonograph Works of Orange, N. J., manufactures the phonographs and applies them. A factory is also to be established at Geneva, Switzerland, in which the American company will own one-quarter interest. The estimated cost of dolls is $1.50 each. The wholesale selling price is to be $3.75, and the retail price $5. The estimated average profit in all countries is $1.50 per doll. The New Jersey works can manufacture 500 dolls per day, or more if required. The company can manufacture all sorts of toys, from talking dolls to barking dogs, but confines itself to dolls at the start. Mr. O. E. Madden, formerly with the Bell Telephone Company, has assumed the management of the company's affairs in Europe." To the above, permit me to add that on Thursday, March 7, the stock of the Phonograph Doll Enterprise (as it is termed in Boston financial circles) was quoted at from 20 to 22.

Electric Welding.—The Thomson Electric Welding Company gave a reception to the members of the press on Monday evening, March 4, at the station of the Malden (Mass.) Electric Light Company. Besides the members of the press there were present a number of electricians, members of the city government and prominent citizens of Malden, Medford and Melrose. H. A. Royce, the general manager of the company, was present, and gave an exhibition of electric welding, which was both novel and interesting. It took just two minutes for the electric current to weld a two-inch solid iron bar, and for the smaller bars less than a minute was required. Bars of brass one-half inch in diameter were welded together and then placed in a vise and twisted until they broke, but in no instance did the rod break where it was welded. On Thursday evening, March 7, the second in the series of public experiments in electric welding took place at the station referred to, and was witnessed by many distinguished business men and electricians. Among these were: Governor Ames, Messrs. Oakes Ames and Dana, Mr. Henry D. Hyde, of the West End Street Railway; Prof. Elihu Thomson, the inventor of the system; C. A. Coffin, of the Thomson-Houston Company; W. S. Bliss, of Irving A. Evans & Co., brokers, Boston; John S. Bartlett, of Lynn, president of the Malden Electric Light Company; Mayor Wiggin and several members of the city government. These gentlemen were received by Messrs. H. A. Royce, vice-president and general manager of the company, and J. M. Smith, one of its directors. The experiments tried were very similar to those of Monday evening, the welding together of all kinds of metals, of various dimensions, from one-quarter of an inch to two inches in diameter. The most general satisfaction was expressed by all present, and the ever growing success of the business was predicted. On the southern wall of the station two cases are placed, and these cases contain specimens of the work accomplished by this wonderful process—welding, shaping, riveting and forging, from the finest thread-like brass wire to an iron pipe 1½ inches in diameter.

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
31 City Trust Building, Philadelphia, Pa., March 9, 1889.

Mount Holly, N. J., glowed under electric lights for the first time on Wednesday night last. It was a complete success.

Mr. Gardiner C. Sims, of the engine building firm of Armington & Sims, is making a ten days' stay in this Quaker city, attending to the interests of his company and combining pleasure with his duties. Mrs. Sims is expected to join him while here.

Laurel, Del., is considering the advisability of having electric lights. The citizens are becoming very much interested in the question, and since a republican has been elected to the United States Senate, nothing is too good for any part of the Diamond State.

The Armington & Sims Engine Company has just sold a 200 h. p. engine to the Thomson-Houston Electric Light Company at Atlanta, Ga., and also two 200 h. p. engines to the West End Street Railway Company, of Boston. This last is a duplicate order.

The Bristol Electric Light and Power Company has just ordered another 500 light alternating dynamo from the Westinghouse Company, and also a second 45 h. p. standard Westinghouse engine. The Westinghouse system is giving great satisfaction to the business men and citizens of Bristol, and is daily growing in favor.

The Edison Electric Illuminating Company, of West Chester, Pa., has been mulcted in the sum of $500, which a jury awarded William Jones, in the suit for damages which he brought against the company for the death of his daughter, Hettie, who was killed by the explosion of a boiler at the central station of the company in December, 1887. The sum asked was $10,000.

A Large Order for High Speed Engines.—Claus Spreckels, the sugar king, has just contracted with the Westinghouse Company for fourteen 60 h. p. standard engines for driving centrifugal machines. One condition of the contract was that the engines must get up full speed within 15 seconds and stop in 30 seconds. The trial test with the centrifugal attached was successfully made by the Westinghouse engine.

Dissolution of Partnership.—H. A. Pinkham and H. B. Cutter, who have been associated in business under the style of the Pinkham Electric Company, have agreed to dissolve partnership. Mr. Pinkham will continue the business at No. 27 South Eleventh street. Mr. Cutter has opened an office at No. 1018 Chestnut street, for doing construction work. He will make a specialty of installing electric light plants in private residences and factories.

Inspecting an Installation.—The newly constructed arc light plant at the Eastern Penitentiary was made the subject of a most thorough inspection last week by the Board of Prison Inspectors, Board of County Judges, Directors of City Departments, and other city and county officials. The verdict, which was very favorable, is quite a compliment to C. R. Arnold & Co., the constructors. The incandescent plant is in process of construction, and will be completed shortly.

Lighting Ocean Steamers.—The Atlantic Transport Company, running between this city, Baltimore and Liverpool, is having all its steamers wired preparatory to placing dynamos in each. Messrs. Walker & Keppler, the Edison Company's agents, are at present wiring five steamers for 100 16 c. p. lamps each, and expect to put complete outfits on the whole fleet. A 150-light Edison dynamo will be placed on each vessel, run by a small high speed engine.

"Light" Flour Assured.—The immense flour mills of the Milbourne Mills Company will soon be illuminated with the incandescent light. This company has just contracted with Mr. R. Muckle, Jr., & Co., to put in a 250 light Westinghouse dynamo for direct current. It will replace a 50 light Edison machine which has been used to light the offices and lower rooms. Mr. T. Carpenter Smith has arranged to run the generater by water power during Sundays and holidays, and on all other days the power will be obtained from the regular engine.

This firm has also sold the Philadelphia Exhaust Ventilating Company a 50 light direct current dynamo of the Westinghouse type for lighting its offices and shops.

Is it a "Pinch" Bill?—Senator Harlan, of Chester County, has just introduced a bill in the State Senate prohibiting all suspended electric wires in cities of over 30,000 population after August, 1889, fixing a penalty of $500 per day for each company violating the provision. Electricians and interested persons all over the state condemn the bill as impracticable, and declare its provisions impossibilities. Chief Walker of the Electrical Bureau of this city

is outspoken in his condemnation. Dr. Plush, General Manager of the Bell Telephone Company, said that his company was placing wires underground as fast as possible, but that Senator Harlan's bill was impracticable, inasmuch as the digging of conduits alone for all their wires would occupy at least a year.

Let Them Have It.—"What street railway men are anxiously looking for," said a well-known street railway magnate last week, "is a good, serviceable, commercially practical, storage battery. We have numerous storage batteries, some good, others indifferent, but all of great value in the laboratory. Now, give us something cheap and practical. There is nothing the matter with the overhead and underground systems of street railways, but what is wanted is a system in which we can convert our present cars into electric tramways, and go on running without all this fuss about overhead wires, underground cables, and a hundred annoying details. We have all the practical motors that can be desired, but what is needed is a storage battery that has a good life, high efficiency, light weight, convenient form for handling, and that will be guaranteed. Then will come the era of swift, sure, safe and pleasant surface traffic."

The Edison Company's Central Station, on Sanson street above Ninth, this city, inaugurated on last Wednesday night, what is hoped to be a long period of renumerative usefulness. Four huge generators delivering 1,000 ampère. of current, driven by two Armington and Sims engines, of 450 h. p., sent electric thrills through the virgin copper cables that lined the walls in horizontal, vertical and sinuous parallels. Part of the current generated was driven through one street circuit and the Union League Building five squares away was flooded with a wealth of brilliancy. It was the first structure to receive a current from the new station, and everything worked smoothly. Professor Wm. D. Marks, who superintended the trial was delighted with the results although it was all expected, without doubt. A very interested spectator was Mr. G. C. Sims, of the Armington & Sims Engine Company, who looked after the performance of his engines. All the officers of the local company were present, and although nothing official was intended in the trial it was most satisfactory to them. The dynamos were kept running all that night and until one o'clock the following afternoon. Another 450 h. p. Armington & Sims engine is being put into position, making four in all, and an order has just been closed for two more of the same type. When the station is completed there will be twenty 450 h. p. A. & S. engines and forty-dynamos of 1,000 ampères each, making this one of the largest stations in the world.

Bristol, Pa.—The Bristol Electric Light and Power Company commenced lighting the town Feb. 17 with 110 lamps of 25 c. p., and are now busy with commercial wiring, the demand for which is far in excess of their anticipations. The first lighting of stores and offices was on the 2d inst., and an amusing feature was the lighting of one of the drug store windows with sixteen candles placed in candelabra with the intention of showing their superiority to the 16 c. p. lights in the windows of the druggist's neighbors. The "light of our fathers" proved a miserable failure in comparison, and the druggist was overwhelmed with offers of snuffers to keep his candles in trim. The townspeople are loud in their praises of the street lights furnished and appear to have full confidence in the ultimate success of the company. The plant comprises a 60 × 16 boiler, two 45 h. p. Westinghouse standard engines, two 500 light Westinghouse dynamos, with ample building and lot. The construction has been under the care of M. R. Mucklé, Jr. & Co., of Philadelphia, and the fact that not a single skip or break has occurred since the first lighting of the station shows the careful attention paid to detail, while the entire plant shows the selection of only the best materials for both station and line. The officers of the company have devoted much time to supervision of the work, with the evident intention of having their municipal and commercial customers thoroughly satisfied, and the indications are that they will soon reap the fruits of their labors, as the orders for wiring and lights show that the dynamos will be loaded in a very short time at a profitable rate to the company. Bristol is a town of 8,000 inhabitants, with gas works which were established over thirty years ago, and the electric light company are therefore in direct competition with a rich and formidable corporation, but the stockholders of each are on the most friendly relations with the other and claim that there is room for both. A notable feature of this installation is that there is not an inch of "undertakers'" wire in the whole plant nor an unsoldered joint in the line. Mr. P. Hatzell is president and Mr. C. E. Scott treasurer.

E. F. C.

WESTERN NOTES

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, March 9, 1889.

Stockholm, Cal.—An isolated incandescent plant of 100 lights, of the Thomson-Houston system, has been sent to Stockholm, Cal.

St. Joseph, Mo.—A large incandescent isolated plant has been installed in St. Joseph. It is for 800 lights of the Thomson-Houston system.

Joplin, Mo.—An isolated plant of the Thomson-Houston system has been increased in the warehouse of O. R. Moffat by the installation of a 50 arc light dynamo.

Mr. D. P. Perry, general manager of the Sperry Electric Company, appeared in his office this week after wrestling for ten days with incipient pneumonia, contracted at the Exposition building.

Shreveport, La.—The Gas Company of Shreveport have had their chart r amended to do an electric lighting business. They have ordered a 65 arc light plant of the Thomson-Houston system.

Lewistown, Ill.—The Lewistown Electric Light, Heat and Power Company has been incorporated. They propose furnishing light, heat and power to local subscibers. The capital stock is $10,000.

The Central Electric Company are increasing their store capacity. The offices, which have been on the ground floor, have been moved up to the second floor. The space left vacant will be used for wareroom purposes. This company is doing a large business and is now becoming crowded for room.

St. Louis Installations.—There have been installations during the past week of 550 lights. These are in two isolated plants. The Bi-Metallic Mining Company of that city has installed a plant of 250 incandescents, and the Granite Mountain Mining Company a plant of 300 incandescents. These plants are both of the Thomson-Houston system.

Telephone Quotations.—Col. S. G. Lynch, broker, 146 LaSalle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$149@$152	Iowa Union	23@ 25
Central Union	49@ 50	Michigan	80@ 81
Chicago	300@ 305	Missouri and Kansas	69@ 70
Colorado	40@ 41	Rocky Mountain Bell	39@ 40
Cumberland	65@ 68	Wisconsin	115@ 117
Great Southern	30@ 35		

A New Fuse Wire.—The Electrical Supply Company, of Chicago, are putting a new fuse wire upon the market. This wire is classified systematically, each number being made to fuse at a certain number of ampères, so as to facilitate ordering. Orders for their automatic ground switch are coming in briskly, and a member of the company expresses the belief that the Convention just held here was of material benefit to the electrical business of this city in the impetus it has given trade.

Springfield, Ill.—A special from the capital states that a movement is on foot to place an electric light plant in the State House, so that the State may control its own light. The capitol building is lighted by 45 Brush lamps. These are owned by the State, but the local lighting company furnishes the electricity, for which it charges $10 a month per lamp. In addition to this charge, which amounts to $5,400 annually, there is a gas bill of about the same amount. If a small dynamo were installed, it is claimed, this expenditure would be done away with, and the plant would soon pay for itself.

Making War on the Telephone Company.—A special from Springfield, Ill., dated Feb. 26, states that the warfare on the Chicago Telephone Company is being conducted systematically, and this morning every member of the Legislature received a copy of the following: DEAR SIR: The undersigned heartily indorses the measure known as the "Eckhart-Baker" bill for the regulation of telephone charges. The Chicago Telephone Company was in January last granted a franchise by the Chicago authorities for twenty years, with practically no limitation as to rates. The rates now charged are extortionate in the extreme. Our only protection against continued injustice is in the Legislature. I respectfully beseech your support of the bill named without amendment, as calculated to afford such just and necessary protection.

Telephone Legislation.—A special dispatch from Springfield says that telephone bills are becoming so numerous there is a possibility that many may be neglected. There is, however, considerable difference in felling touching the merits of the case among the legislators themselves. Some think that the telephone companies ought to be regulated directly by the Legislature; while others think that the city councils should deal with the companies under their own immediate supervision. Some time ago, a bill was introduced, which made a uniform rate of $2 monthly throughout the State. Eight years ago the yearly rate was $75 in Chicago, now it is $125. It was claimed that the Chicago Telephone Company declared a semi-annual of 60 per cent.! This was cited as an example of the immense profits made by taking advantage of the power to put rates where the desire prompted. The discussion was then held over for a week.

The Jenney Company's Decision.—Ever since the destruction of the Fort Wayne Jenney Electric Company's shops by fire, some three months since, there has been a great deal of speculation as to where the company would locate, proposals having been received by them from various Indiana cities. It is now definitely settled. The company having, it is stated, sold a controlling interest to a Boston syndicate, represented by Mr. Charles A. Coffin, of the Thomson-Houston Company, the control of the relocating has passed out of their hands. Mr. Coffin, in a late visit to this city, agreed that if $30,000 in the way of a bonus was raised in Fort Wayne, the shops should be re-erected there. Twenty-eight thousand dollars have now been pledged and the rest of the money is "in sight." The architect's plans for the new buildings on the old site imply an expenditure of $40,000.

Electrical Development in the Far West.—The city of Kearney, Neb., is making some rapid strides in electrical business. Although a small, though growing city, it already has a number of factories run entirely by electrical power. The power station has only a capacity at present for 100 h. p., but apparatus for 300 h. p. has been ordered, and is to be immediately set up. It is an evidence of the growing interest in electricity as an agent for power in the West, that a large power station is now being built. At a natural fall of water just above the city a mill-race has been built, and three turbine wheels are about to be set up. The station itself is to be built by the Frank Improvement Company, of Kearney. It is to be of pressed brick, three stories high. It will contain the offices of the company and the dynamos and other machinery necessary. Although the output of power will be a great deal less at first, the capacity of this power station will be 10,000 h. p. The city has a pressed brick industry also, the works of which are operated by electricity.

Electrical Death Penalty.—The same discussion that took place in New York by the Medico-Legal Society, regarding death by electricity, or "electro-thanatos," as a contemporary puts it, is now going on here. The Chicago Medico-Legal Society held a meeting to discuss the subject, and their views were very inimical to the general adoption of the project. This agitation is called up largely because a bill has been introduced into the Illinois legislature which has the same import as the one recently carried in New York. Eight physicians spoke on the subject, and of this number there were but two who approved it in any way. The feeling was decidedly in favor of continuing the present method of capital punishment—that of hanging. On the ground of humanity, it was claimed that the amount of suffering the criminal endures, is greatly overestimated. More than one physician there indorsed the statement that after the noose tightened there was no further consciousness, and the subsequent twitching of the muscles was simply nervous. It was argued that electricity was a youthful science, and it would injure it from a commercial standpoint to make of it an agent for capital punishment. A copy of the minutes of this meeting is to be sent to the legislature.

A New Car Motor.—Last week the Patton Motor Manufacturing Company, of Chicago, was incorporated at the State House, at Springfield. They propose to manufacture and sell motors for street car service. The patent covers more ground than the first car equipment will show, and the second will be the criterion of the company's plan. It is then the second that interests the electrical public. This is in effect a storage battery system with the charging plant on the car. A small gas engine of the Charter type will be set up in the forward end of the car, and a one or two horse-power dynamo is to be connected with it. Under the seats on either side of the car are to be placed storage batteries, which are to be kept constantly charged by the dynamos which, with the engine, will be in a separate compartment in the end of the car. The rest of the car will be used as a smoker after the fashion of the cable roads here in Chicago. The motor will be underneath the car, as is the custom in most systems. The advantages claimed by the company are these: In the first place the gas engine can be operated at a very slight expense, and the dynamo at no expense at all. The power then is obtained for almost a percentage of what horses cost. Again, by having the batteries constantly recharged there is no need of two sets, which is the prevalent custom with other systems. Neither will they be so large, and consequently so expensive as the other kinds. Their aggregate weight will be but about 500 pounds it is claimed, scarce a third of the other batteries. This car will be out in a month or two, and practical demonstration will settle the worth of the system.

The capital of the company is $250,000, nearly all of which is subscribed and paid in. The original construction company was from Denver, Col. Feeling that Chicago was more central to the electric interests the new company claims Chicago as a birth-place.

W. A. N.

SOUTHERN NOTES.

RICHMOND, Va., March 8, 1889.

Telegraphs.—Superintendent Kates, of the Postal Telegraph Company, tells me that his company is rapidly extending its lines to this point, and will soon open an office in Richmond, where it hopes to secure a fair share of the telegraph business now handled exclusively by the Western Union. Superintendent Tree, of the latter company, seems to rather admire the idea of a little competition. The Western Union has just absorbed the lines of the Chesapeake & Ohio Railroad, running all the way from Newport News, Va., to Cincinnati. The C. & O. heretofore did an independent telegraph business in opposition to the Western Union. Thus, you see, the Western Union continues to keep up its reputation for gathering in the smaller companies that either stand in its own way or might prove of advantage to competing companies like the Postal.

The Electric Road.—The electric railway here has evidently given satisfaction, for it is to be considerably extended at once. In fact, the company is now at work making the alterations necessary to change about 12 miles of road from a horse—or, to be more exact, a mule-car line to what our English cousins would call an electric tramway. This will just about double the present length of track. The number of electric cars will also be doubled. There are now 40; 50 more are to be added. It is thought that the changes will be completed in about a month, and then the Virginia Electric Light and Power Company, which operates the road hopes to give the Richmondites even better satisfaction and more efficient service than it has heretofore. It is only fair to the company and to the cause of electric railways in general to say, however, that to the inquiries I made among those in no way connected with the electrical business, I got but one reply: "The electric road is a great success and has given a wonderful impetus to the growth and development of the city." Everybody seems to take a laudable pride in it, and everywhere along the line of the road houses are going up, which shows how quick the citizens are to take advantage of the facilities it offers for rapid and comfortable transit between their offices and homes. Superintendent Trafford tells me that everything about the road and its electrical features runs along smoothly and pleasantly. A trip over the road, such as I made to-day in company with Mr. M. B. Leonard, can not but convince any one of this fact; and it is a long ride for five cents. I was much pleased with the neat, tidy and business-like appearance of the power station, which, I ought to mention, also furnishes current for about 4,000 Westinghouse incandescent lights, as well as some 40 commercial motors—Sprague, Daft, Baxter, etc. In addition to this, the company, from another station, runs 300 Schuyler arc lights. It gets a very fair rate for the motor service—$125 for the first h. p. and $100 for each additional h. p. The equipment of the station includes at present six No. 16 and one No. 20 Edison machines, one 2,600-light and one 650-light Westinghouse machine. The engines consist of three Armington & Sims of 125 h. p. each, two Westinghouse of 65 h. p. each, one Westinghouse compound of 250 h. p. and one Ide of 150 h. p. The boilers are fitted up with the well-known Jarvis furnace. Another Armington & Sims engine will be put in when the changes in the road are finished, to run two more No. 20 Edison machines. An additional 2,600-light Westinghouse dynamo has also been ordered to enable the company to meet the increasing demands upon it in this department of its business.

The Gas Works in Richmond are owned and operated by the city. The price of gas is $1.50 a thousand feet. In his message transmitted to the Common Council on Monday of this week, Mayor Ellyson makes a number of recommendations which will interest the readers of THE ELECTRICAL WORLD.

Referring to the subject of gas, he says: "We must put our works in good condition and then reduce the price of gas to at least $1.25 per thousand feet, and even less to large consumers. This reduction will be necessary if we expect to keep our largest customers, to whom the Electric Light Company is already offering liberal inducements to use their light." The Mayor thinks the city should supply electric lights as well as gas, and therefore ought to have an electric light plant of its own. This is the way he puts it: "The city is now under contract with the Richmond Schuyler Electric Light Company for electric lights. We are using 135 of their lamps on our streets and in our public parks, which cost $144 each per annum. The contract provides that these lamps shall be of 1,200 candle power and shall burn all night of each and every night in the year. The present contract expires in 1891, and I would earnestly recommend that the city purchase and erect a plant of its own. Both economy and sound public policy require this. We have decided that it is wise for the city to furnish the people with artificial light, and in view of this it is just as important that we should control the electric as the gas light. It would be well for the Council to begin at once to consider this question so as to put itself in possession of such information as will enable it to act intelligently when the time for action comes. I would also urge the advisability of placing the control of all matters pertaining to light, whether electric or gas, under the control of one committee. I am sure this would be found of great advantage, especially if the city should decide to have her own electric plant." His Honor also indorses "the recommendation of Superintendent Thompson for the appointment of an electrical inspector, whose duty should be to examine all electric light and power wires placed in buildings."

W. J. J.

THE TELEGRAPH.

Green Island, N. Y., is to adopt a fire alarm system.

Fresno, Cal.—Taxpayers are petitioning for an electric fire alarm system.

Braidentown, Fla.—Telegraph and telephone supplies are wanted by Mr. R. H. Roesch.

San Diego, Cal.—A district telegraph franchise has been applied for by Mr. G. W. Thompson.

Baker City, Ore.—The Baker County Telegraph and Telephone Company has been formed at Baker City by H. C. Bowers, J. Manandas and H. S. Bowen, with a capital stock of $30,000.

Postal Telegraph Cable Company.—At a meeting of the directors of the Postal Telegraph Cable Company, on March 5, the following officers were elected: President, Albert B. Chandler; vice-president, George S. Coe; treasurer, Edward C. Platt; secretary and auditor, George R. Williamson; attorney, Alfred W. Kent.

Edwin Gould Succeeds His Father.—The stockholders of the Washington and New Orleans Telegraph Company met on March 6 in the Western Union building and re-elected their old board of directors, with the exception of Jay Gould, who retires from the board and is replaced by his son, Edwin Gould. The board of directors is now composed of Norvin Green, president; R. H. Rochester, secretary and treasurer; W. H. Abel, trustee; Russell Sage, Thomas T. Eckert, Edwin Gould, George J. Gould, John Van Horne and J. B. Every.

Newark District Telegraph Company.—The stockholders of the Newark District Telegraph Company held their annual meet-

ing last week, and selected the following to act as directors: George W. Hubbell, Marcus L. Ward, Thomas T. Kinney, Edward Weston, Enos Runyon and Frederick T. Fearey. The company has just declared and paid its second annual dividend of five per cent. It is now proposed to extend the business of the company to all parts of the United States by the introduction of a new extension fire-alarm telegraph system invented by Frederick T. Fearey and John Speicher.

THE TELEPHONE.

California.—The Paradise Telephone Company has built a line from Paradise to Chico.

National Telephone Exchange Association.—The office of the Secretary, Gen. Barney, is hereafter located at 510 West 23d street, this city.

Florida.—The Florida Phonograph and Phonograph-Graphophone Company, has been formed by H. T. Baya, C. B. Rogers and others, with a capital stock of $75,000.

Kansas.—Special Agent Knight of the American Bell Telephone Company is moving against the Phillipsburg Telephone Company and other infringers using the "Viaduct instruments."

Emporia, Kan.—Mr. Stockwell, of Burlington, Kan., has been placed in charge of the telephone exchange at Emporia and Mr. Mackey has been transferred to Kansas City as inspector.

The Telephone in Illinois.—At Springfield, Ill., on March 7, the State Senate passed a law to regulate telephone charges in the State. The telephone regulators are also reported to have gained a victory in the lower house of the Legislature.

Hearing Sermons in New Brunswick.—Mr. A. A. Knudson recently enabled a number of people at St. John, N. B., to hear a sermon preached in the Methodist Church at Fredericton, 85 miles away, by means of the long-distance telephone service of the New Brunswick Telephone Company, Limited.

The Telephone in Connecticut.—The extent to which the telephone has entered into Connecticut's social and business life is graphically shown by the summary of the figures in the Southern New England Telephone Company's annual report which has just been published. There are 2,586 circuits in the State, 6,981 miles of wire, of which 753 are copper, and 5,719 stations, 2,793 of which are business places; 194 persons are given employment.

Northwestern.—A special dispatch from Minneapolis of March 4 says: The annual meeting of the stockholders of the Northwestern Telephone Exchange Company was held to-day. The old board of directors, with the exception of James W. Bennett, were re-elected as follows: Charles E. Adams, Charles J. Glidden, Wesley A. Gove, John E. Hudson, Francis Jewett, J. W. C. Pickering, A. C. Russell, Thos. Sherwin, Levi Sprague, James A. Weston and Harvey A. Whiting. The election was unanimous. The board of directors will organize at Lowell. The Northwestern Company is one of the sub-companies of the Erie, the stock being all owned by the Erie directors in trust for the Erie company, excepting the interest owned by the American Bell Company for the perpetual franchise.

THE ELECTRIC LIGHT.

Massachusetts has 78 electric light companies.

Red Oak, Ia., is to have an electric light plant.

Florence, Ala.—Mr. E. B. Cowley is to put in a plant.

Sweetwater, Tenn.—Electric lighting is under discussion.

Gastonia, S. C. will, it is reported, adopt electric lighting.

Marietta, O.—The city has voted to pay $15,000 for its plant.

Chico, Cal.—Anthony Bros. are to put in a new electric light plant.

Ravenna, O., proposes to buy out its local gas and electric light plants.

Van Wert, O., is to have an electric light plant of the Silvey system.

Emporia, Kan.—B. F. Wasson is putting in electric apparatus at Emporia.

Topeka, Kan.—The city electric lighting plant is using petroleum for fuel.

Dallas, Tex.—Mr. W. A. Disborough is in the market for a 20 light arc plant.

Frostburg, Md.—A central station plant is to be put in by Mr. W. H. Evans.

Lexington, Va., will, it is reported, have an ice factory and electric light plant.

Duke, Ga.—H. C. Williams & Co. want a cheap electric light plant for their mill.

St. Charles, Mo.—The St. Charles Gas Company has an electric light franchise for 15 years.

Yorkville, S. C., will probably be furnished with a Brush plant by Mr. L. M. Campbell.

Oxford, O.—The city has voted to issue bonds for $25,000 to spend on an electric light plant.

Delphos, O., proposes to put in a plant from the Silvey Electric Light Company, of Lima, O.

Columbia, S. C.—The Board of Regents contemplate putting an electric light plant in the asylum.

Newman, Ga.—Mr. M. F. Cole is desirous to purchase a 50 h. p. engine for the new incandescent plant.

Albany, Ga.—The local Edison Company has contracted to light the city and will enlarge its plant.

New Decatur, Ala.—The city council is now investigating the expense of gas and electric light plants.

Charleston, W. Va.—The Kanawha Electric Light Company will increase its steam and electric plant.

Nevada City, Cal.—Mr. A. Tregidge has asked for a franchise for an incandescent central station plant.

Whatcom, W. T.—The Fairhaven Land Company proposes to put in an electric light plant at Whatcom.

Fernandina, Fla.—Mr. R. S. Schuyler is ready to receive bids on the putting in of an electric light plant.

Stockton, Kan.—The city of Stockton now owns the electric light plant, having paid $6,000 for the outfit.

Bayonne, N. J.—The Bayonne Electric Company has offered the city 157 arcs at $110 per lamp per annum.

Santa Clara, Cal.—A new machine has been added to the plant by the Electric Improvement Company.

Yorkville, S. C.—Mr. J. J. Hunter reports that the question of electric lighting at Yorkville is still unsettled.

Covington, Ky.—The capital stock of the new Covington Electric Light, Heat and Power Company is $15,000.

Searcy, Ala.—Mr. M. G. Petty is interested in a new electric light company being organized for local business.

Goldsboro, N. C.—The plant for which Mr. O. H. Foster, of Raleigh, asked a franchise for is about to be built.

Wallaceburg, Ont.—Mr. J. Dunkley is putting in a plant for electric lighting inclusive of a 60 h. p. Ball engine.

Bowling Green, O.—The new Bowling Green Electric Light and Power Company has a capital stock of $10,000.

Roanoke, Va.—The capital stock of the Roanoke Electric Light and Power Company is to be not less than $200,000.

Michigan.—A bill is before the Michigan Legislature authorizing gas companies to do an electric light business.

Tiffin, O.—The Tiffin Gas Light Company has bought a plant o 150 arc lights from the Western Electric Company.

San Marcos, Tex.—According to Mr. H. Hardy, the mayor, the city will probably build or buy an electric light plant.

The Madison Square Theatre, this city, is putting in some rich and novel fixtures and effects for electric lighting.

Fostoria, O.—The Fostoria Electric Light Company has a new contract from the city for five years, of $5,000 per annum.

Staunton, Va., is to have an incandescent electric light plant. A company has been organized by J. Hotchkiss and others.

St. Charles, Mo., proposes to give the gas company electric lighting privileges for fifteen years, beginning with 20 arcs.

Fort Scott, Kan., will open bids for electric lighting on April 1. Mr. L. K. Scofield is the superintendent of street lighting.

Winchester, Va.—The Winchester Gas Company has made a contract for the steam plant to run its electric light apparatus.

Lima, O.—It is stated that the Silvey Electric Light Company is busy on new orders and will build a large factory in the spring.

New Bedford, Mass.—The Ne Bedford Gas Light Company is increasing the boiler capacity of it electric light plant by 125 h. p.

Batavia, N. Y.—The new electric light company has a capital stock of $25,000 and is to put in a Westinghouse plant of 1,000 lights.

Fort Leavenworth, Kan.—The military prison at Fort Leavenworth, Kan., has been lighted with 305 incandescent lights.

Chattanooga, Tenn.—Mr. G. R. Pennock has turned up in Chat tanooga to organize another Pennock Battery Lighting Company.

San Francisco, Cal.—A. Mather plant is to be put in the California Theatre and Hotel, of 2,640 light capacity, with three engines.

Concord, N. C.—The Concord Electric Light Company has been formed with a capital stock of $30,000, and will put in an Edison plant.

Burlingt on, Kan., has a new plant in operation of 15 arcs, 15 incandescents of 65 c. p. and 35 incandescents of 25 c. p. Everybody is pleased.

Atlanta, Ga.—The contract for gas and electric fixtures for the State Capitol has been awarded to W. Wilmarth & Co., of Chicago, for $10,000.

Columbus, Ind.—The City Council has made a contract for one year with the Citizens' Electric Light Company at $52 per light for 50 lights.

Alco, Ala.—The Peter Lumber Company, of Alco, near Brewton, Ala., are said to be contemplating the use of the electric light in their mills.

Ithaca, Mich., has no street lighting system, but is agitating the subject, and Mr. J. P. Gibbs, the town clerk may be addressed on the subject.

St. Joseph, Mo.—It is believed that a majority of the city council will vote in favor of electric lighting when the gas contract expires on May 1.

Savannah, Ga.—The Oglethorpe Electric Company has been formed with a paid-up capital of $50,000 to establish electric light and power plants.

Milwaukee, Wis., has the comical idea that its electric lighting needs can be met by the $25,000 plant it is now asking legislative permission to buy.

Wyandotte, Kan.—The electric light company has between forty and fifty miles of wire in position. When completed they will have over 300 lights.

Kirkwood, Mo.—The Kirkwood Electric Light and Power Company has been formed by C. A. Kitchen and others, with a capital stock of $5,000.

Texarkana, Ark.—The Texarkana Gas and Electric Light Company, Mr. E. M. Maxwell, President, has been formed, with a capital stock of $200,000.

Redwood City, Cal.—A Ball plant has been installed at Redwood City by Mr. J. B. Ridley. Twenty-six arcs are in operation and more are called for.

Wallingford, Conn.—The gas company, which has, under its charter, the exclusive right to light the streets, is now asked to engage in electric lighting.

Kingman, Kan.—The electric lighting plant and fixtures have been purchased by B. D. Wright, of Peterburg, Ill. The city will probably be lighted again.

Duquoin, Ill.—Mr. G. F. Blakeslee, the proprietor of the Duquoin Iron Works, has been granted an exclusive electric light franchise for twenty years.

Council Bluffs, Ia.—The Council Bluffs Electric Light Company's new and large station will be running, it is said, in sixty days, with 2,250 Westinghouse lights.

Austin, Tex., Electric Plant.—A bill has been introduced into the Legislature to appropriate $30,000 for an electric plant for the capitol building and grounds.

Maceio, Brazil.—The city of Maceio, Brazil, has contracted with Argemiro Augusto da Silva to illuminate the principal part of the city with the incandescent light.

Stoughton, Mass.—The Stoughton (Mass.) Gas and Electric Lighting Company are now running 50 Ball 800 c. p. arc lights, and it is expected that 20 more will be added.

Louisville, Ky.—It is stated that the Louisville Gas Company will probably make an issue of $250,000 bonds to be used in installing a plant for electric light and power

Montrose, Col.—The Montrose, Col., Electric Light Company has been incorporated by F. W. Hamlin, A. Heibler, and C. E. McConnell, with a capital stock of $10,000.

Dansville, N. Y.—The Dansville Electric Light Company has purchased a Westinghouse alternating current dynamo of 500 light capacity, and a 40 arc Waterhouse dynamo.

Newburyport, Mass.—The Newburyport Gas Light Company will increase its capital stock $60,000, to raise the purchase price of the plant of the local Electric Lighting Company.

Hartford, Conn.—The Hartford Electric Light Company has declared a semi-annual dividend of 3 per cent. on its capital of $200,000. It is supplying 675 arcs and 3,000 incandescents.

Newark, N. J.—The Newark Electric Light and Power Company has been formed by J. V. Clarke, F. Watts, F. S. Peck, J. F. Moffett and C. T. Moffett, with a capital stock of $20,000.

A "Wrecking" Plant.—Tha Merritt Wrecking Company of this city, has ordered a special wrecking plant from the United States Company, to assist in night operations on wrecks.

Chicago, Ill.—The Milward Avenue Electric Company has been formed by G. Martin, M. L. Willard and A. A. Bliss with a capital stock of $25,000 to do a heating, lighting and power business.

San Diego, Cal.—An offer of $400,000 has been made by Eastern capitalists, it is said, for the plant of the San Diego Gas and Electric Light Company, but $500,000 is demanded as the selling price.

San Jose, Cal.—Mr. H. J. Edwards has transferred his electric light franchise to the San Jose Gas Company, and the city authorities have sanctioned the action. A plant will be put in at once.

Chehalis, Wash. Ter.—The Chehalis Water Company, in which Mr. Ray is interested, is to put in an incandescent plant of 500 lights, the dynamos to be driven by the water works engine.

Olympia, Cal.—The Olympia & Tumwater Railway Light and Power Company has been organized to build electric roads, electric light plants, telegraph lines, telephone exchanges, etc., at Olympia.

Washington, D. C.—The Washington Electric Light Company has been formed by B. H. Warner, A. T. Britton and others, with a capital stock of $1,000,000, to put in a large Thomson-Houston plant.

The Self Storage Electric Light and Power Company has been incorporated in New Jersey, by C. R. Stevenson, of Camden, J. H. Jenkins and J. L. Chapman, with a capital stock of $500,000.

Baltimore, Md.—The local Waterhouse Company, through Messrs. Biedler, Adams & Rennert, offers to do city lighting, etc., at 40 cents per night for five years. The company has ordered four 50 h. p. engines.

Michigan.—The Peninsula Electric Light Company, of Hancock and Houghton, Mich., is making arrangements to put in a central electric light plant at Red Jacket. It is designed that the plant shall also light Calumet.

Danielsonville, Conn.—The Killingly Electric Light Company has been formed at Danielsonville, with Mr. F. A. Jacobs as president. The company will put in a 500-light incandescent plant for street and commercial lighting.

Cadillac, Mich.—The Commer Electric Light Company has put in a Thomson-Houston plant with a capacity of 60 arc lights and 600 incandescent lights. The company has purchased the Waterhouse plant and now operates both systems.

Harvard, Ill.—The Harvard Electric Light Company, of Harvard, McHenry County, Ill., has been incorporated by W. F. Fay, E. D. Stiles and J. Eason; capital stock, $16,000; formed for the purpose of furnishing electric and other light and power.

Ashland, Ore.—The Ashland Electric Light and Power Company has been incorporated with a capital of $15,000, to furnish electric light and power in Ashland. The incorporators are: Fordyce Roper, A. C. Helm, H. B. Carter, L. D. Fielles and S. B. Galey.

Winchester, Va.—The Winchester Gas Company, C. E. Hoover, superintendent, has the contract for electric lighting for five years, with 40 arcs of 1,500 candle-power, at $70 per annum, midnight schedule. The company has not yet bought its plant.

Pine Bluff, Ark.—The Pine Bluff (Ark.) Water and Light Company have placed an order with the Pond Engineering Company for one additional steel boiler of 100 h. p. capacity, and a 125 h. p. Armington & Sims engine, being their third engine of that make.

Gardner, Mass.—The Gardner Electric Company, E. Carpenter, superintendent, is putting in a 125 h. p. Fitchburg compound condensing engine, two 80 h. p. steel boilers, two 500-light Thomson-Houston alternating machines, and a 50-light Thomson-Houston arc machine.

The Ashland (N. H.) Electric Light Company has organized, with Thomas P. Cheney, president; Hiram Hodgdon, James M. Cotton, James N. Nichols, Lorin Webster, Thomas P. Cheney, directors; Francis M. Hughes, secretary and treasurer; capital stock, $6,000.

St. Petersburg, Russia.—A St. Petersburg correspondent writes us that a new city electric light and power supply company has been established there with a capital stock of $175,000. This company has bought from Benardos the right to use his process of welding by electricity.

Electric Light Bids Wanted in Mexico.—The State of Oaxaca, Mexico, is open to bids for a 100 light 2,000 c. p. arc light plant complete. Bids will be closed April 12. Full information can be obtained by addressing the treasurer-general, Sen. Luis Garcia Luna, Oaxaca de Juarez, Mexico.

Winnipeg, Can.—The Lighting Committee are to advertise for proposals for electric lighting by arcs and incandescents; for 50 lights or more of the arc system, to be not less than 2,000 c. p., or its equivalent in number and lighting capacity of the incandescent system, the contract to run for three years.

North Topeka, Kan.—A. W. Morrell, of Indianapolis, general superintendent of the Jenney Electric Light Company, has been at North Topeka for the purpose of starting the machinery of the North Topeka Electric Light Company. The engine was started on Feb. 22, and the machinery works like a charm.

Jonesboro, Ark.—A local company has been formed by J. Dixon, M. Bergen, J. B. Dillon and J. Perkins, all of Jonesboro, to put in an incandescent plant during the spring. They will start with steam apparatus of 75 or 100 h. p., and will contract for dynamo capacity of about 600 lamps of 16 or 20 c. p.

Nickerson, Kan.—Mr. C. E. Decker is the manager of the electric light plant, as the result of the recent negotiations. He is operating a three-wire Jenney plant, and will add an arc light plant as soon as possible. The company is known as the Nickerson Electric Light and Power Company, and now bids fair to grow and prosper.

Belleville, Ill.—The Sperry Electric Company, of Chicago, have recently shipped a 20-arc light improved Sperry dynamo and outfit of lamps complete to the Belvidere Electric Light Company, and it is already in operation. This makes the fifth Sperry machine added at Belleville, showing a lively appreciation of the merits of the system.

Ottawa, Ill.—The Illinois Valley Electric Light and Power Company, at Ottawa, has received incorporation license from the Secretary of State; the capital stock of the new company is $20,000, and it will be incorporated for the transmission of electrical energy for light and power. The incorporators are C. L. Ballard, Lewis Degen and D. E. Degen.

The Edison Machine Works at Schenectady, N. Y., is negotiating for the purchase of eight acres of land in the vicinity of the present huge factory on which to erect several large buildings to provide for the increasing business. The company now employs 750

men, and the proposed increase of capacity will call for a large addition to its working force.

Waterloo, N. Y.—The Waterloo Electric Company is lighting the village streets with 50 arc lamps. It has three Excelsior 30-light machines, with a McIntosh, Seymour & Co. compound condensing engine. It is supplying also 25 commercial lights, and contemplates putting in two 400-light Edison machines for incandescent work. Mr. A. G. Mercer is the treasurer.

Benton Harbor, Mich.—The Benton Harbor & St. Joseph Electric Light Company has been organized by I. W. Conkey and J. B. Morrison, of Benton Harbor; W. Ballengee and R. S. Collins, of St. Joseph, and W. W. Bean and W. G. Keith, of Cincinnati, O. Capital stock, $25,000. The plant will be located between the two towns, and arc and incandescent lights furnished.

Nevada City, Cal.—A well-known mining man, who has secured the right, for Nevada County, of furnishing incandescent electric lights, under a new and improved system, will soon apply to the authorities of Grass Valley and Nevada City for franchises to erect poles and maintain wires in the streets of the two towns. The projector of the scheme expects to furnish illumination for residences.

La Grange, Ga.—The firm of Dallis & Edmundson report to the Baltimore *Manufacturers' Record* as follows: "The La Grange Cotton Mills, the machinery of which is now being placed, are negotiating for electric lights. It is probable that the city will join with the La Grange mills. The oil mill, plow works, variety works and our two female colleges, etc., consummate a trade for the lighting of all within the next sixty days."

Pleasanton, Kan.—The citizens of this place have been agitating the question of lighting the city by electricity and the scheme is favored by the majority. It would be a grand improvement and we hope to be able to announce the commencement of work on it soon. The money requisite for establishing a plant could undoubtedly be raised among the business men and no time should be lost in starting the thing along.—*Observer.*

Even Hickenlooper Converted.—It is announced that General Andrew Hickenlooper, president of the Cincinnati, Ohio, Gas Light and Coke Company has determined on the introduction of electric lighting on a large scale by that company in conjunction with its gas service. As this company is noted for not doing things by halves, we may expect soon to see Cincinnati one of the best lighted cities in the country.—*Progressive Age.*

A Noteworthy Bill.—A bill was recently introduced in the Pennsylvania Legislature providing that any company, incorporated in the State for the purpose of supplying light, heat and power, by whatever means, shall have exclusive rights in its chartered district "until the said corporation shall have from its earnings realized and divided among its stockholders during five years a dividend equal to eight percentum upon its capital stock."

Council Bluffs, Ia.—A new electric light company is being organized to put in a Brush plant. The *Nonpareil* says: "It is their desire, however, to put in a plant of 2,000 light capacity which will cost about $30,000. The idea seems to prevail that there is ample room for at least two good companies in Council Bluffs, and if our citizens desire to take hold of the matter the Brush Company promise to lend substantial aid. A committee will be appointed to solicit stock, and another meeting will be held in the near future."

Frankfort, Ky.—The Capital Gas and Electric Light Company, of Frankfort, has purchased from the Western Electric Company a complete electric light plant of two dynamos, each of 25 lights, 2,000 c. p., steam apparatus of 100 h. p., wires, poles, lamps, etc. The company has erected a new building on the corner of Miro and Washington streets, 32 × 62 feet, brick, for the station, and expects to be running by March 15. Mr. D. W. Lindsey is the president, Mr. E. L. Samuel, secretary and treasurer, and Mr. S. J. Shea, superintendent.

Bids for Street Lighting.—The N. Y. Gas Commission has ordered that advertisements be published for gas and electric street lighting for the year beginning May 1, the bids to be opened March 27. Mayor Grant insisted that no bid shall be received which would make necessary the use of poles and overhead wires. Provision is made for 800 new gas lamps and 10 more electric lights in Desbrosses and West Third streets. There are now in use 1,325 electric light lamps and 23,732 gas lamps. It is possible for the electric light companies to shut off the light at any time, as the city has no contract with any of them excepting the East River Electric Light Company, and they have been supplying the light for months without payment.

Electricity in Denver.—It is said that the two electric lighting companies in Denver may eventually consolidate. The Colorado Electric Company was organized in 1880 by Messrs. Cheseman, Duff, Wolcott, Tabor, Daniels, Fisher, Rollins, Vaile and others. This company contracted for a small arc plant and has been adding to its plant ever since. Some three years ago it received the contract for furnishing the city with both arc and incandescent lights and at this time has a capacity of 4,500 arc lights and 1,600 municipal incandescent lights. The officers of the company for the past year have been E. W. Rollins, president; N. M. Tabor, vice-president; F. C. Young, secretary and treasurer; John W. Flintham manager. Two years ago the Denver Light, Heat and Power Company was incorporated, with the intention of introducing incandescent lights for illuminating purposes and fuel gas for heating purposes. The works of this company are located in the building of the Colorado Electric Company on Wewatta street. An underground cable system was started through the city, and at this time the company furnishes over 10,000 incandescent lights. The officers of this company for the past year have been: Dennis Sullivan, president; A. H. Fowler, vice-president; J. H. Morris, secretary and treasurer; John W. Flintham, superintendent. The same parties are interested in each company and they have come to the opinion that both companies can be operated more economically as one organization than as two different companies. Consequently the move for a reorganization of both as one company. The business of the companies has grown to such an extent that it is deemed desirable to secure a president and general manager who can give the companies an intelligent management. This gentleman is Mr. C. H. Smith.

APPLICATIONS OF POWER.

Amourdale, Kan.—Work is to be begun at once for the electric railway.

Plainfield, N. J.—The Daft road in Plainfield will be operated with storage batteries.

Washington, D. C.—It is proposed to extend the Tenallytown electric road to Rockville, Md.

New Orleans, La.—The New Orleans Electric Light and Power Company are to equip a short electric road.

Fort Worth, Tex.—The East Fort Worth City Company propose to build a dummy or electric road to Sylvania.

Laredo, Tex.—The Laredo Improvement Company will operate its new road by electricity.

Red Bluff, Cal., is to have an electric road, obtaining current from the electric light station.

Newport, R. I.—The City Council has voted in favor of electricity for the new street railway.

Fort Worth, Tex.—The West Fort Worth Street Railroad Company has asked for the right to operate by steam or electricity.

Dallas, Tex.—The proposed electric road is to be built by the Dallas Consolidated Street Railway Company.

Elizabeth, N. J.—The Union & Essex Electric Street Railway Company has been organized and has applied for a franchise.

Stockton, Cal.—The Street Railroad Company will probably turn its road into an electric one, using the Sprague System.

Troy, N. Y.—It is stated that the Troy & Lansingburgh Railroad Company will soon operate their line by electricity.

Raleigh, N. C.—The Raleigh Street Railway Company have amended their charter so as to operate by electricity.

Eastport, Me.—The Eastport Electric Company, J. F. Campbell, superintendent, is in the market, it is said, for storage batteries.

Parkersburg, W. Va.—The Parkersburg Street Railroad Company is making arrangements for building its electrical road this spring.

Negaunee, Mich.—The three-mile electric road between Negaunee and Ishpeming will probably be operated by water power ten miles away.

St. Joseph, Mo.—The Wyatt Park Railway Company is preparing to build its electric line north to Jule street and thence out to the city limits.

Winston, N. C.—The Winston Electric Street Railroad Company has applied for its charter, under which it will operate an electric road and stationary motors.

Fulton Street, New York.—It is stated that the Bentley-Knight system in Fulton street will be put in operation about the end of April, or beginning of May.

Ashland, Ky.—The new company formed to build an electric road between Ashland and Catlettsburg has Mr. A. C. Campbell as as secretary and Mr. R. D. Davis as treasurer.

The Bentley-Knight system for street railways, using both the overhead and the conduit system, is the subject of an elaborate article, a page long, in the New York *Sun* of Feb. 24.

Omaha, Neb.—The Omaha Motor Railway Company has been re-organized with a capital stock of $500,000 and will adopt electricity. Dr. S. D. Mercer is President; W. Millard, Secretary; and W. L. Adams, Engineer.

Salem, Mass.—Mr. Perry Collier reports as follows: "We have arranged with the Weston Company, of Boston, to run the Beverly & Danvers road one year by storage battery, the road to be finished and running June 1."

Port Chester, N. Y.—The Bentley-Knight Company is equipping the road of the Portchester, White Plains & Tarrytown Street Railway Company on the overhead system, connecting with the New York Central and Northern & New Haven steam roads.

Wichita, Kan.—So great has been the success of the Riverside electric road that General Manager Dickson, of the Wichita Street Railway Company, is now negotiating for a plant to cover 10 miles of his system, using overhead wires, with the pole line between the tracks.

Richmond, Ind.—Mr. J. C. Shaffer, owner of the street railway, is in consultation with electric motor people, with the object of changing from horses to electricity as a motive power. The overhead system is to be used. It is said that $50,000 is to be spent on the work.

The New England Julien Electric Company has been formed, with a capital stock of $1,000,000. It controls the right to the system for electric traction, etc., by arrangement with the Julien Electric Company and Julien Electric Traction Company of New York.

Nashville, Tenn.—The City Electric Railway Company has been organized to build an electrical street railroad, and have asked for permit. The capital stock is $40,000. Isaac T. Rhea is president; James H. Bruce, vice-president; Sanford Duncan, secretary, and R. W. Turnear, treasurer.

Chattanooga, Tenn.—W. K. Burton, H. Clay Evans, W. A. Willingham, W. H. Russell and others have chartered the Chattanooga, Missionary Ridge & Chickamauga Railway Company to build an electrical railroad to the Chickamauga battle-field. Mr. Burton is in the field for "the best system for electrical railroads."

Emptying a Senate.—Upon the occasion of the recent visit of the Massachusetts State Senators to the Sprague West End road, there was such a rush of the members that there were not enough left in the capital to make a quorum of the Senate, a circumstance which has not been paralleled, it is said, for twenty-seven years.

Salt Lake City.—The Salt Lake City (Utah) Street Railway Company has decided to operate five miles of its line on some electric system, and hopes to have the same in operation by May. Ten of the old cars of the Twenty-third street line, New York, have been purchased, and will be used for the equipment of the electric road.

Des Moines, Ia.—Mr. H. O. Woodruff reports having sold during the past month a large Hawkeye power dynamo for Des Moines; a 6 h. p. Hawkeye motor for the *Leader* Printing Company; a 3 h. p. motor for P. C. Kenyon, printer; a ⅓ h. p. for A. Davidio, cutler, and a ⅛ h. p. C. & C. motor for the Cross Manufacturing Company.

St. Joseph, Mo.—Mayor Englehart has signed the electric ordinance for the Avenue and Citizens' lines and the companies shortly afterwards filed a formal acceptance of the same with the city clerk. Joseph A. Corby, superintendent, to-night leaves for New York City with full authority to make the transfer of the prop to the Eastern syndicate.—*St. Joseph Herald.*

Sprague Electric Transfer Tables.—The Sprague Electric Railway & Motor Company is making the driving plant for a transfer table for the Philadelphia & Reading. This is the third transfer table that this company has equipped. The first was put in at Aurora for the Chicago, Burlington & Quincy about nine months ago, and the second will soon be in operation at the Pennsylvania shops, Altoona.

Utilizing the Tides.—There is a curious water-wheel in use at Bowdoinham, probably the only one of the kind in existence. It is 27 feet in diameter, with a foot of its rim out of water at high tide; the spokes are wide and set diagonally, like the vanes of a windmill. It turns 18 hours a day by tide power—running one way with the flow, the other with the ebb. With one foot fall of the tide the wheel is said to give about 50 horse-power. Here is a hint for electrical engineers.

Illinois City, Mo.—The Electric Railroad Company, of Illinois City, has filed articles of incorporation in the recorder's office at Belleville. The object for which the company is formed is to build an electric railway from the approach to the Merchants' bridge in Venice to East St. Louis. The capital stock is $50,000, and the incorporators are Seth W. Cobb, C. C. Rainwater, John Whittaker, of St. Louis; Charles D. McLure, Granite, Mont., and L. M. Rumsey, Hennepin County, Minn.

Kansas City, Kan.—The stockholders of the West Side Electric Railway held a meeting in Kansas City, Kan., on Feb. 19, and decided to build their line from Thirteenth street and Minnesota avenue to Chestnut street, thence to Fifteenth, from which street they will go to the Quindaro Bulevard. The return line will be laid from the Boulevard to Cobb's Place, thence to Edgerton Place; thence to Third street and Minnesota avenue. The preliminary survey will be commenced at once.

Port Chester, N. Y.—The Port Chester, White Plains & Tarrytown Railway Company are busily preparing for their new Bentley-Knight electric road on the overhead system. The company has given a contract for a stone and brick building 130 feet long, 85 feet deep and two stories high. It is to contain offices, two 80 h. p. engines, two 80 h. p. boilers, two 80 h. p. dynamos and storage rooms for 25 cars. The section between Elmsford and Tarrytown and that between White Plains and Port Chester will be begun in about a month. J. M. Schuyler is secretary and treasurer of the company.

PERSONALS.

Mr. Nathan P. Stevens will be the superintendent of the electrical department of the Concord, N. H., Gas Light Company.

Mr. Townsend Wolcott has become associated with the Mutual Electric Manufacturing Company, of Brooklyn, as electrician, etc.

Mr. T. A. Edison narrowly escaped the loss of his eyes by a recent explosion of chemicals with which he was experimenting in his laboratory.

Mr. Antonio Meucci, the well-known associate of Garibaldi, and one of the alleged inventors of the telephone, has been seriously ill at Staten Island.

Mr. John Paul Bocock has some stupid and doleful lines in the New York *World* of March 10, called "The Song of the Wires," a parody on "The Bells."

Mr. W. F. Collins, who represents the Callender Company in the Eastern States, was in New York last week. The dynamo designed by this ingenious young electrician has been taken up by a new company in Boston, and will shortly be introduced.

Mr. J. F. Morrison has been very ill at Baltimore since his return from the Chicago Electric Light Convention, in whose proceedings he took so active a part. The doctor has ordered absolute quiet and no one has been allowed to see him for some days.

Mr. George A. Hamilton, so long and so well known as the electrician of the Western Union Company, joins the New York electrical staff of the Western Electric Company, which of recent years has wonderfully strengthened the personnel of its various departments.

Lieut. Bradley A. Fiske is spoken of as the navigating officer for the new dynamite cruiser "Vesuvius." Lieut. Fiske is thoroughly conversant with the new type of gun and the new methods of naval warfare, and it would be hard to make a better selection for the post.

Mr. Frank Kitton delivered an able and instructive address on March 4 before the Buffalo Electrical Society on "Electric Street Railways," and there is no doubt that he has sown some good seed in promising ground, "even in Buffalo, probably the most conservative city in the adoption of new and advanced ideas."

Mr. Theodore N. Vail receives some hearty compliments from ex-Postmaster General James in the latter's article on "The Railway Mail Service" in *Scribner's Magazine* for March. Mr. Vail is mentioned as one of the four men to whom the excellence of the present system is due, and, in fact, the settlement of the fast mail service in 1877, on a permanent basis was "a victory not reached without untiring efforts on Mr. Vail's part."

Mr. S. Z. Mitchell.—We were pleased to receive a call this week from Mr. S. Z. Mitchell, of the Northwestern Electric Supply and Construction Company, Seattle, Wash. Ter. Mr. Mitchell, who graduated with the class of '83 at Annapolis, is now the president of the above named company, and reports the installation of upwards of sixty central station and isolated plants in his territory, embracing the apparatus of the Edison, Thomson-Houston and Sprague Companies.

Mr. J. Y. Bradbury.—The following interesting item is from the Lowell, Mass., *Morning Times* of March 4: "Superintendent J. Y. Bradbury was a popular man with the employés of the Middlesex Electric Light Company and they very much regret his resignation. Being anxious to show some testimony of their esteem they concluded to make him a present. Mrs. Bradbury was let into the secret and yesterday afternoon was selected as the time to make the visit on account of its being the most available time for the employés to leave their work. About a score of the employés took a car at 2 p. m. and on arrival at the residence of Mr. Bradbury, 167 Westford street, took complete possession of his house and also thoroughly mystified him. After a few minutes of pleasant conversation Engineer Sam Wade stepped forward and in behalf of the employés presented Mr. Bradbury with a handsome silver water service. One of the pieces bore the inscription: "J. Y. Bradbury. Presented March 3, 1889." Mr. Wade made a neat presentation speech expressive of the regard felt by the employés for Mr. Bradbury. That gentleman feelingly responded and assured the donors of his high appreciation of the testimonial of their esteem. The speeches over, Mrs. Bradbury had ice cream and cake on hand in a moment, and when it had been fully enjoyed cigars were forthcoming, and a pleasant social season ensued. About 3:30 the visitors were obliged to leave, and as they went each one cordially grasped Mr. Bradbury by the hand and wished him happiness and prosperity in his future career."

MISCELLANEOUS NOTES.

The Haddell Block System.—Mr. W. H. Haddell is forming a company with $50,000 capital to manufacture his electric block system for railroads.

The United States Auxiliary Fire Alarm Company, of this city, has been formed by H. P. Simmons, R. Payne and F. E. May, with a capital stock of $300,000.

The Electrical Wiring and Construction Company, of Brooklyn, has been formed by W. A. Belcher, G. W. Hunt, and C. T. Carret, with a capital stock of $25,000.

The Microphone Battery Company, of New York City, has been incorporated by J. G. Noyes, F. J. Stevens and M. R. Corkey, with a capital stock of $5,000 to make and sell electrical apparatus.

Hughes Fixtures.—The Hughes Manufacturing Company has been formed at Covington, Ky., by R. F. Hughes, W. Hays and E. F. Sprague, with a capital stock of $50,000, to manufacture gas and electric light fixtures, etc.

The Standard Railway Signal Company has been formed at Columbus, O., to manufacture the electric signal system for railways of Mr. A. Z. Boda. The capital stock of the company is $10,000. Mr. J. B. McDonald is president.

The Electric Hydraulic Company has been organized at Pittsburgh by J. P. Witherow, R. F. McFeely, H. F. Floy, M. H.

Herron and F. J. Edmundson, with a capital stock of $10,000, to manufacture electric and hydraulic machinery.

Philadelphia, Pa.—City Electrician Walker declares it an utter impossibility to put 12,000 miles of wire underground in six months, as would be required by the Harlan bill now before the State Senate. This bill provides that in cities over 30,000 population all wires must be buried by August, and a daily fine of $500 be imposed for violating the law. The cost of this little operation in Philadelphia is put at $5,000,000.

The Hypnotizing Phonograph.—Dr. Pinel, of Paris, has succeeded in hypnotizing several subjects by means of the phonograph. All the commands given through this channel were as readily obeyed as those uttered directly, and "suggestions" of every possible sort were as effectually communicated through the medium of the machine as if made *viva voce*. The conclusion deduced by Dr. Pinel is that the theory of a magnetic current passing from the operator to the subject is entirely baseless, and that the real cause of the phenomena of hypnotism is nervous derangement on the part of those subject to them.

The Dallas Electrical Society, of Dallas, Tex., a young and vigorous body which deserves every encouragement, has established a museum and library, and is inviting contributions to one or both repositories. Anything in the way of books, catalogues, samples, models, etc., will be welcome. The society will pay any express charges. Mr. J. M. Oram is president, Mr. H. Garrett, treasurer, and Mr. C. O. Harris, secretary.

A Military Balloon, on the system perfected by MM. Gabriel Yon and Louis Goddard, was tested successfully at the Champs de Mars, Paris, lately. The balloon and hydrogen gas generator, dynamo machine, telephone, search lights and three chariots to carry them about, only weigh 2,500 kilogrammes. The balloon was inflated in six hours, and went up with the entire cargo. A height of 500 metres was attained in a few minutes. A telephone wire and a wire for an electric light are imbedded in the strands of cable that attach to the balloon, three chariots, something like gun carriages, carry about the whole concern, each drawn by four horses. Balloon batteries similar to that system have been adopted by the French, German, Russian, Austrian and Italian armies.

A Tribute to Mr. Cleveland.—The following has been issued by the New York Associated Press: "The retirement of Mr. Cleveland from the Presidency affords a fitting opportunity for the Associated Press to make some recognition of the uniform courtesy with which its representatives have been received at the White House, and the intelligent interest that has been exhibited in placing at its service promptly and without the annoyance that too often accompany official acts everything that might properly be given to the public. While the Associated Press has always been on pleasant terms with the occupants of the White House, the fact that the press was a servant of the people and the proper medium through which to reach them, was never so clearly understood before the Administration of President Cleveland. The experience of Colonel Lamont as a journalist was undoubtedly useful in establishing such sensible and practicable relationship with the Associated Press at the very beginning of that Administration."

Electrical Executions.—Several State officials of prominence connected with the prison system will assemble here this week, it is said, and make the final series of experiments needed to prepare for enforcing the Electrical Execution act. Those who will be present will include Gen. Austin Lathorp, superintendent of State Prisons; C. K. Baker, the assistant superintendent; Warden Brush of Sing Sing Prison, and Dr. Carlos F. MacDonald of the State Asylum for the Insane. At the close of the experiments, which will be conducted by Harold P. Brown, an electrical engineer of this city, the State will proceed to the purchase of electrical plant. It will also be necessary to decide whether certain prisons will have permanent dynamos and apparatus, or whether one portable dynamo will serve all the prisons. Consultations will be held with a board of physicians to decide upon the exact mode for the administration of the fatal current.

BUSINESS NOTICES.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas lighting batteries if accidentally grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, No. 3 South Warren street, Syracuse, N. Y.

Patterson, Jordan & Gottfried, 146-150 Centre street, carry a complete stock of brass and iron machine and wood screws cap and set screws, all kinds of bolts, taps, files, twist drills, brass and rubber tubing, brush copper, rod and sheet copper, brass rod, sheet German silver, sheet brass, machinery, tools, hardware, etc. Electric motor supplies.

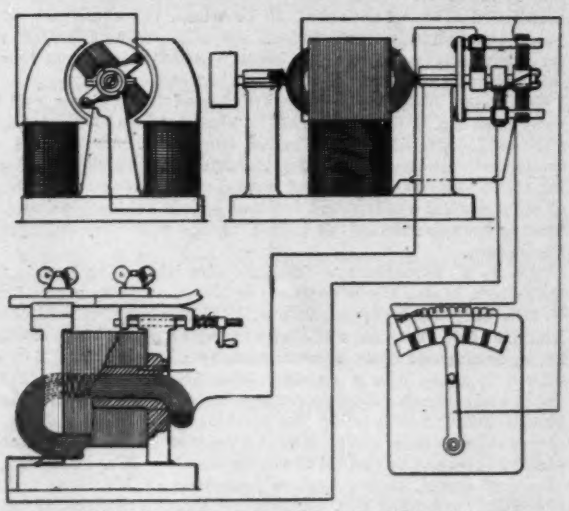
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED MARCH 5, 1889.

10,989. (Reissue.) Telephone Exchange; W. B. Van Size, Plainfield, N. J. Application filed Nov. 27, 1888. Claim: The combination in a telephone exchange, of a central station and a series of sub-stations, a series of electrical conductors uniting said central station and sub-stations, telephone instruments at each for the purpose of intercommunication, switching apparatus at the central station for connecting said conductors in pairs, and an automatic switch at the central station making and breaking connection with each of said conductors periodically.

398,814. Electric Tramway; H. T. Blake, New Haven, Conn. Application filed Nov. 30, 1888. The invention consists in constructing the top surface of the base or conduit of a rounded or roof-shaped form, thus providing a free water shed over its entire upper surface, the conductor channel being closed along or near the highest point thereof.

398,833. Printing Telegraph; F. H. W. Higgins, London, Eng. Application filed May 29, 1888. The leading features of the apparatus are the following: A manipulator and a printer connected by two electric circuits with automatic apparatus in the manipulator for continuously opening and closing a circuit and keeping in rotation a type-wheel in the printer. Finger-keys in the manipulator depressed by the operator stop this automatic apparatus and also the type-wheel whenever the latter arrives in position for printing. The same finger-keys close the printing-circuit and bring the printing mechanism into use. The matter thus transmitted is printed upon a page, line by line. An indicator in the manipulator shows, for the information of the operator, the number of letters struck in any line being printed. By the manipulation of a finger-key the index of this indicator is returned to the starting point and the apparatus brought into position to print a new line. This is accomplished by the transmission of a printing-current when the shaft of the type-wheel is in a given position, corresponding with a blank upon the type-wheel, and the operation of the printing mechanism at this time moves the paper forward for the next line to be printed upon it.



398,913. ELECTRIC WELDING MACHINE.

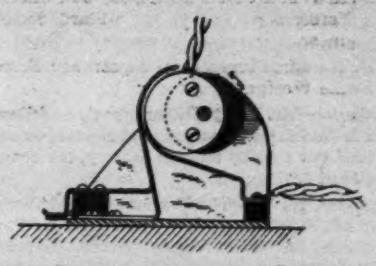
398,870. Hanger Board for Arc Lamps; James J. Wood, Brooklyn, N. Y. Application filed Dec. 14, 1887. Claim: In a hanger board for electric lamps the combination with conducting suspension eyes or loops in connection with the terminals of the circuit, of conducting springs, also in connection with the terminals of the circuit, adapted to press into the loops, with polar hooks or suspenders on the lamp, adapted to engage between the loops and the springs.

(1) 398,906. (2) 398,907. (3) 399,088. (1) and (2) Arc Lamps; (3) Dynamo-Electric Machinery; William L. Silvey, Lima, O. Applications filed, respectively, Feb. 21, 1888; July 23, 1888, and Oct. 1, 1888. (1) and (2) The lamp is intended for multiple arc circuits and the inventions consist of the details of construction. (3) Relates to construction of the field magnet core for holding the wire in place and collecting and distributing the magnetism of the coils.

(1) 398,912. Method of Manufacturing Screws and Bolts by Electricity; (2) 398,913. (3) 398,914. Electric Welding; Elihu Thomson, Lynn, Mass. Applications filed May 17, 1888; June 2, 1888, and Oct. 8, 1888, respectively. (1) It consists essentially in forming the screw portion and the shank or plain portion separately, and uniting the two by the electric welding process. (2) The invention consists essentially of a power driven dynamo, of any suitable construction, supplying alternating electric currents directly to an induction coil, the primary of which is of larger resistance than the secondary, while the secondary connects with the work by means of the holders or clamps or other devices. See illustration. (3) In an electric metal working apparatus, rigid supports, upon which the clamps or holders for the work are directly supported, in combination with independent conducting pieces for supplying current to the work through a path independent of the rigid supports.

(1) 398,926. Electric Current Regulator; (2) 398,927. Electric Current Regulator; J. W. Balet, New York, N. Y., Assignor of one-half to R. Dunlap and L. F. Cozans, of same place. Applications filed Jan. 27, 1888, and May 14, 1888, respectively. (1) The object of the invention is to provide a current regulating apparatus for dynamos and motors by which the current not used and any surplus of current will be sent into accumulators to be stored for future use when the main current from the dynamo becomes weakened or ceases altogether, and to control the charging of the secondary batteries, so that the charging current shall cease in a particular battery when the maximum charge is reached and be returned to the said battery when it is discharged. (2) The invention consists in arranging a device formed of a helix and a pair of soft iron bars supported movably in the helix, each bar being connected with a switch arm adapted to move between a pair of contacts connected with the circuit in which the helix is placed.

398,963. Crossing Conduit for Electric Railways; L. W. Heysinger, Philadelphia, Pa. Application filed April 21, 1887. The invention consists in a crossing conduit for electric railways having two or more transverse passages through which the current gathering devices of an electric motor can pass, said transverse passages opening laterally into each other and provided with insulators and longitudinal conducting leads; the leads are interrupted at the intersection, and the free ends of the leads joined by laterally deflected wires carried in insulated ducts.



399,228. CIRCUIT CLOSER FOR RAILWAY CAR TELEGRAPHS.

399,016. Stretcher for Mechanical Telephone Line Wires; A. W. Butterworth, New York, N. Y. Application filed Aug. 6, 1888. A tension device for overhead wires, consisting of a main support, as a pole, a lever pivoted upon the pole, a bridge piece for carrying the wire attached to one end of the lever, and an adjustable counter weight on the opposite end of the lever.

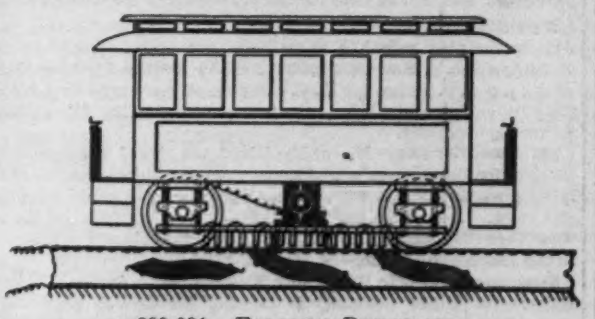
399,019. Process of Electric Welding; C. L. Coffin, Detroit, Mich. Application filed Sept. 18, 1888. The process consists in placing the two articles against each other and welding the joint by simultaneously traversing such joint by an electric current and subjecting it to the action of a voltaic arc.

399,052. Secondary Battery; Edward R. Knowles, Brooklyn, N. Y. Application filed Dec. 1, 1888. A method of making secondary battery plates consisting in first treating the finely divided oxides with sulphuric acid or a solution of the same until all of the oxides which it is possible to be acted upon by the acid are sulphated, then pasting the same on to the grids, then pickling the grids thus prepared in different solutions of acid and water successively, the solutions being of gradually increasing strength, and finally forming the same for use. See p. 159.

399,054. Electric Arc Lamp; Geo. M. Lane, Auburn Park, N. J. Application filed May 3, 1888. In an electric lamp the combination with the feed-controlling magnets, the one in the main circuit and the other of high resistance in a derived circuit and composed of a series of sections, of a circuit closer and an auxiliary magnet in the main circuit to control the circuit closer to bring more or less of the resistance magnet in the derived circuit.

399,057. Interrupter for Electric Circuits; I. E. Lecoultre, Lausanne, Switzerland. Application filed Sept. 21, 1887. Claim: The combination with the base and cover of insulating material, and metallic segments upon the base, and a movable piston, of a bent loop-shaped friction spring secured at its central portion to the cover, and having its free opposing ends curved to frictionally grasp and hold the piston.

399,059. Electric Motor; O. Lugo, New York, N. Y. Application filed Aug. 8, 1888. The principal object is to so commutate the currents that the tangential pull had upon the armature bobbins and their cores as they rotate past the successive field bobbins, may be had at two or more radial points at one and the same time.



399,091. ELECTRIC RAILWAY.

399,084. Couch for Applying Electrical Treatment; J. B. Schmalz and J. B. Faulkner, Norfolk, Va. Application filed Dec. 28, 1888. A couch having a compartment for a battery and provided with electrodes so arranged that prominent parts of the body will be in contact therewith when reclining upon the couch.

(1) 399,091. (2) 399,092. Electric Railways; Harry W. Smith, Newark, N. J. Application filed Sept. 14, 1888. (1) An electric railway having a sealed conduit provided with a conductor, an air impelling device, contact plates and armatures for connecting said conductor and contact plates. See illustration. (2) The object of this invention is to provide electric cars such as have magnets thereon or beneath them adapted to affect certain armatures on the railway to produce a continuous metallic circuit from the electric generator to the motor on the car. A magnet holder, magnets, and a plate of non-magnetic metal arranged between the magnet and railway when the car is in operation.

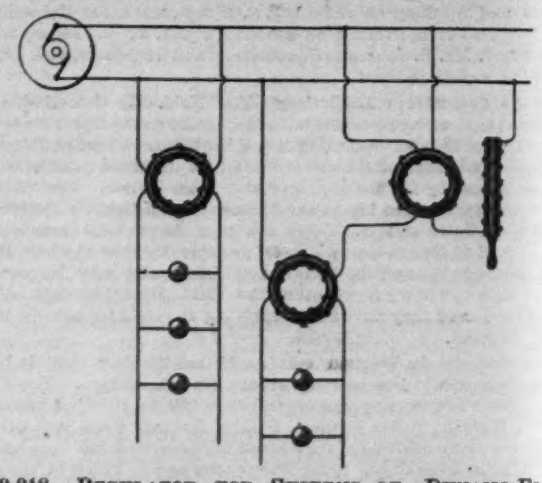
399,128. Self-Winding Electric Clock; F. W. Brainerd, Chicago, Ill. Application filed May 25, 1888. The object is to provide a reliable device for giving a step by step movement to the winding mechanism, which will insure an immediate interruption of the circuit connections after each step by step movement, thereby saving the battery power.

(1) 399,134. (2) 399,135. (1) Electric Lamp Fixture and Switch; (2) Electric Switch; L. W. Dillon, North Attleborough, Assignor of one-half to H. M. Daggett, Jr., of Attleborough, Mass. Applications filed Aug. 7 and Oct. 3, 1888, respectively. (1) The fixture comprises a base of wood or other insulating material provided with binding posts or connectors for the current supplying conductors and with a switch controlling a direct connection between the said binding posts, so arranged that an imperfect contact cannot be made. (2) The switch is loosely pivoted on a spindle or arbor and extends on both sides of said arbor, so that lateral pressure on the switch-arm at one side of the arbor or pivot tends to turn the switch in one direction, and lateral pressure in the same direction, but at the other side of the arbor or pivot, tends to turn the switch arm in the opposite direction.

399,137. Electrical Store Service Apparatus; R. N. Dyer, East Orange, N. J., Assignor to Wm. S. Lamson, of Lowell, Mass. Application filed June 29, 1887. In electrical store service apparatus the combination with the way formed of two parallel tracks placed close together in the same horizontal plane and connected with opposite sides of the circuit, of a carrier having wheels in the same horizontal plane riding upon both of said tracks, an electric motor mounted upon said carrier and receiving current through said wheels, and a receptacle supporting bail depending from the carrier on one side of the way.

399,154. Automatic Telegraphy; John O'Neil, New York, N. Y. Application filed July 6, 1886. In an automatic multiplex instrument, a continuously energizing electro-magnet interposed in the main line circuit, and independent intermittently energized electro-magnets in alternate circuit with said main line, in combination with the styluses vibrated by said continuously energized magnet, and independent electrodes in intermittent circuit with said main line.

399,163. Electric Signal for Engine Shafts; J. C. Ricketson, Milwaukee, Wis. Application filed Oct. 4, 1888. The invention has reference to devices for indicating at any point distant from the shaft of an engine the direction in which the said shaft is revolving, as well as to indicate the speed of such revolutions.



399,218. REGULATOR FOR SYSTEMS OF DYNAMO-ELECTRICAL DISTRIBUTION.

399,168. Electric Cigar Lighting Device; W. Tag and S. C. Smith, Philadelphia, Pa. Application filed July 13, 1888. A burner tip constituting one electrode and having a guiding lip or groove adapted to guide the sliding electrode or wiper over the gas jet.

399,209. Electric Amalgamator; J. H. Rae, San Francisco, Cal. Application filed Feb. 16, 1888. The fine metal held in mechanical suspension is deposited upon a cathode.

399,213. Dynamo-Electric Machine; J. H. Robertson, Rutherford, N. J. Application filed Jan. 29, 1887. An armature formed of a set of discs provided with projections of magnetic material, combined with a less number of plain discs arranged at intervals.

(1) 399,218. (2) 399,219. Regulator for Systems of Electrical Distribution; Lewis B. Stillwell, Pittsburgh, Pa., Assignor to the Westinghouse Electric Company, of same place. Applications filed Oct. 26, 1888. The invention consists in developing a normal electromotive force at the central station sufficient to supply the requisite difference of potential to the translating devices included in the circuits, having the least loss or drop, and increasing the difference of potential upon any given circuit by applying a supplemental electromotive force to that circuit sufficient to compensate for the loss or drop, or raise the difference of potential to any required extent that may be desired for other reasons. See illustration.

399,224. Electric Regulator; F. C. Wagner, Ann Arbor, Mich. Application filed Oct. 20, 1888. A thermal electric regulator consisting of the following elements: A thermal conductor carrying multiple contacts and a shunt having multiple contacts located near the first set of contacts.

399,228. Circuit Closer for Railway Car Telegraphs; George I. Hopkins, Manchester, N. H. Application filed Dec. 21, 1887. This circuit closer is adapted to be used in systems of train telegraphs in which the outgoing and return conductors are carried through the cars in a cord corresponding in position and function to the ordinary bell cord. See illustration.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1836—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Potter Building, N. Y.

UNIVERSITY OF CALIFORNIA